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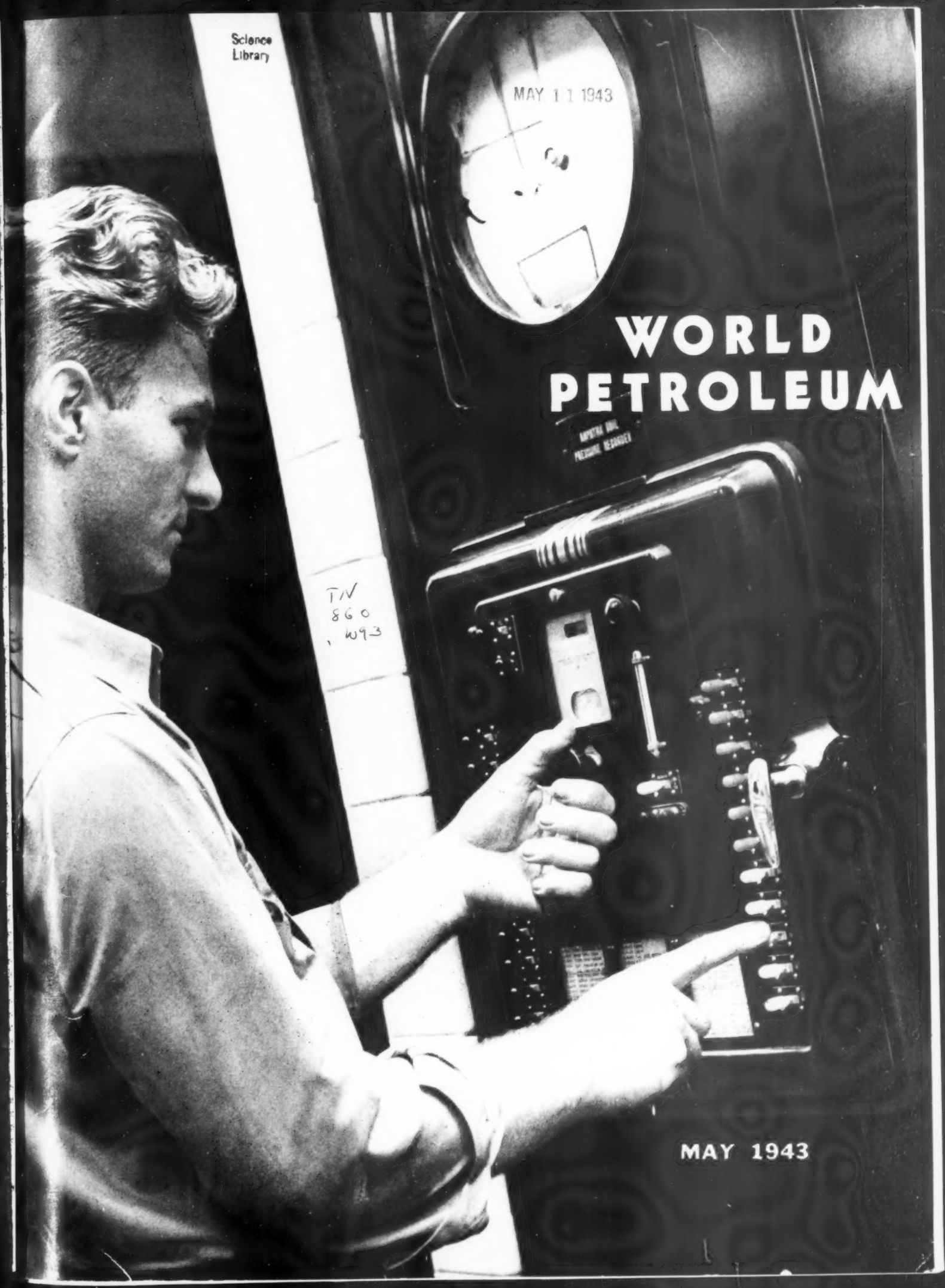

WORLD PETROLEUM

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MAY 1943

USERS WILL *Demand More of Trucks*

AFTER THE WAR

Never before have automotive vehicles been called upon to render the services they are rendering to our United Nations cause in this war. The difficulties encountered in transporting men and materiel across desert and plain, over mountains and through jungle marshes have created an appreciation of the *All-Wheel-Drive* principle of propulsion, which will influence automotive design and construction for all time. No longer will truck users be content with vehicles that lose their power and effectiveness once they leave firm footing. The millions of men who have experienced the startlingly different performance of *All-Wheel-Drive* in military service, will see to that.

Our job now, at Marmon-Herrington, is to help win the war. We are doing it by building trucks, armored cars and tanks, and by buying War Savings Bonds. All this, that we, and you, may return the sooner to the normal American way of life—when Marmon-Herrington vehicles will again be available to all who need them.

MARMON-HERRINGTON

All-Wheel-Drive

MARMON-HERRINGTON CO., Inc., INDIANAPOLIS, INDIANA
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WORLD PETROLEUM

INCORPORATING PETROLEUM EQUIPMENT EXPORTER

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

VOLUME 14 | MAY, 1943 | NUMBER 5

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Rex W. Wadman
General Manager

E. W. Mayo
Editor

Victor N. Raiser
Managing Editor

Jack Seiden
Art Director

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Walworth valve on casinghead stabilizer tower in Continental Oil Company's Lake Charles Refinery. Photo by Ulric Meisel

EDITORIAL

WARTIME NEEDS AND OIL PRICES

UP to the time when these lines were written no definite action had been taken by the Office of Price Administration on the recommendation of Petroleum Administrator Ickes for an increase of thirty-five cents per barrel in the ceiling price of crude oil. The only indication of the probable treatment of the proposal is the remark attributed to Sumner T. Pike, head of the fuel oil price division of O.P.A. that this seems "a pretty bad time" for such an increase. Mr. Pike's observation, if reported correctly, undoubtedly was meant to suggest the unwisdom from a political viewpoint of permitting a price advance for any commodity directly following the President's widely heralded "Hold the line" order against general wage or price increases that would contribute to a rise in the cost of living. It implied an assumption that the public would be unable to distinguish between a price adjustment that would have merely this effect and one inextricably related to the successful prosecution of the war.

Price Administrator Brown revealed a better appreciation of the fundamental issue involved when he said that it was clearly the obligation of his agency to raise the price of oil if that was essential to the conduct of the war. He did not admit that he had been convinced of such a connection between the two subjects; in fact he insisted that it was incumbent upon the petroleum industry to make a convincing showing of such relationship; but he did put the matter on the sound and unassailable basis that it should be decided in accordance with national needs and the national interest. It is a problem of providing every possible assurance that the nation shall have available for its own use and that of its allies an unfailing supply of those petroleum products which are being revealed more and more clearly month by month as the first essential of victory.

On this postulate the oil producers are satisfied to rest their case providing the facts be fully investigated and the standard of measurement fairly applied. Of the all-important place of petroleum as an instrument of war there no longer can be any question. War requirements of petroleum products have been multiplied again and again as the course of the conflict has shown the vital part played by aerial attack and defense and the absolute dependence that has come to be placed on the use of mechanized equipment in ground operations. Hardly any military authority will be found today to question that in this epic conflict the side that has the greater supply of oil—and of the war machines that depend on oil—is the side that will emerge triumphant in the final issue.

In the face of these conditions it would be trifling with destiny to neglect any step that would or might give the fighting forces of the United Nations the power to deal the enemy the final punch at the earliest possible moment. To sustain and expand the decisive superiority that they now possess requires not only the maximum of safe production from existing fields, but the discovery of new sources of supply and the continuance in production of many thousands of wells which are approaching abandonment with the consequent loss of millions of barrels of recoverable oil because they no longer repay the cost of operation. If this means, as it clearly does, that oil must command a higher price than during the days when supply was far outrunning demand as one lush pool after another was uncovered it still will be the cheapest conceivable form of national insurance.

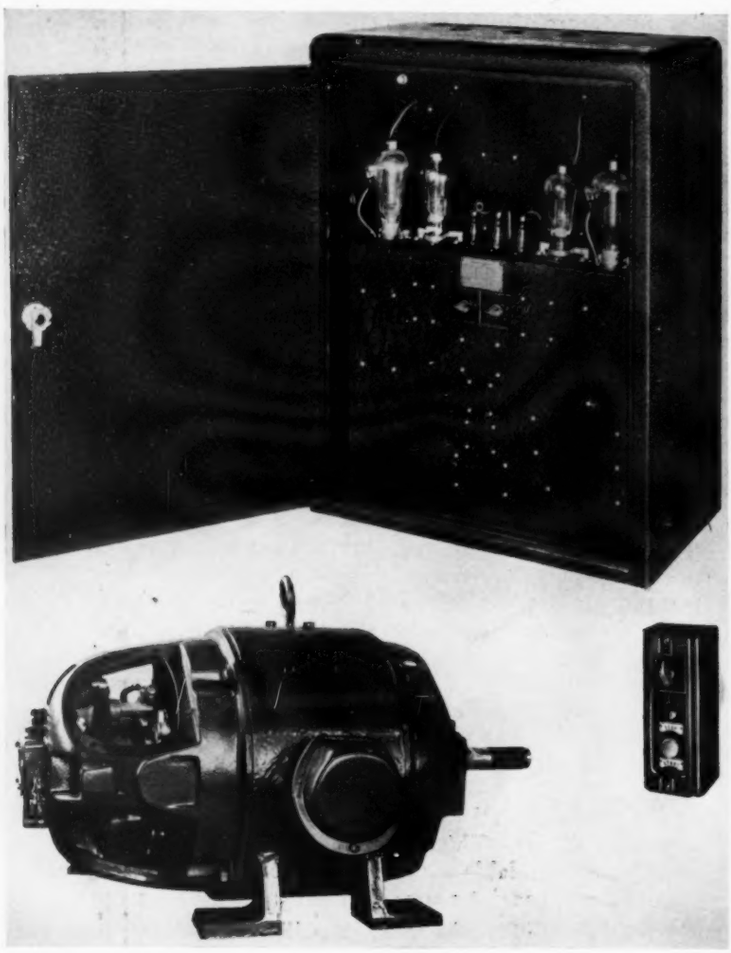
The intimate relation of petroleum to the successful prosecution of the war has caused many voices to be raised in warnings that a policy of drift will lead only to disaster. Judge Cole who for nine years headed a special Congressional committee engaged in a study of the oil situation has stated bluntly in a report to the President that a shortage would make itself felt within two years unless an increased supply could be developed. A report published at the end of last year by a House sub-committee headed by Representative Lea of California stated "We have the choice of increasing our production of petroleum or decreasing our military plans to conform to our oil supplies." Many extensive reports and careful studies have demonstrated that the cost of adding to the nation's oil reserves has increased greatly and from all present indications will continue to rise in future. This is a condition resulting from easily understandable causes and no amount of insistence upon the maintenance of rigid price ceilings can change it or supply the products imperatively needed.

To meet an enormous demand for many kinds of war machines and materials a simple but highly effective plan has been followed. Prices have been placed high enough to provide a reasonable and constant margin above costs. Preference has been extended in obtaining needed materials and equipment for the expansion of output and provision has been made to cover development expense and to insure against loss on purely wartime investments. It has worked with complete success in many other industries, why not in oil?

WHAT'S NEW IN PETROLEUM EQUIPMENT

While the demands of war have increasingly absorbed the facilities of the petroleum industry the deepening of the struggle has not stopped the progress of research, the march of invention or the improvement of the many kinds of equipment that enable the industry to carry on its operations with ever increasing efficiency. It is well that this is so. The need for discovering economical methods of procedure and for conserving critical materials is greater in time of war than in the days of peace. Moreover there is no shadow of doubt that on the heels of the conflict now raging will come a period of intense activity in the development of oil resources in every part of the world and of intense competition in supplying the plants, machinery and tools that will be needed in this new and greater era of industrial progress. It is with pleasurable satisfaction therefore that World Petroleum presents its annual review of progress in oil industry equipment as an evidence of the industry's faith in the future and its steady advancement in preparation for meeting future demands.

WESTINGHOUSE ELECTRIC & MFG. COMPANY



Electronic Mot-O-Control cabinet, push-button control station and d-c motor.

FOR application on industrial drives, such as machine tool feeds, winding reels, conveyors, and fabricating and converting machinery, a new electronic adjustable-speed drive, the Mot-O-Trol is announced by Westinghouse that provides close speed regulation over a 20 to 1 speed range for d-c motors operating from an a-c source. Features of the electronic drive include stepless speed control, automatic close speed regulation over wide load fluctuations, full torque at extremely low speeds, smooth stepless acceleration and dynamic braking. At present, a standard drive is available for ratings up to one horsepower for single phase operation on 110 to 220 volt, 60-cycle systems. Special drives of larger horsepower rating can be designed to suit particular application requirements. Particulars can be obtained from the makers.

The standard Mot-O-Trol is designed to automatically regulate a present motor speed so as to maintain essentially constant speed regardless of load. The d-c voltage output of the main rectifier tubes is controlled by small tubes to compensate for speed changes. For a speed range of 10 to 1, with torque varying from no load to full load, speed will not vary more than four percent from a present value. Maximum variation for the 20 to 1 speed range is within eight percent. No additional rotating part, other than the d-c motor is required. No separate line starters or field rheostats are necessary.

✦

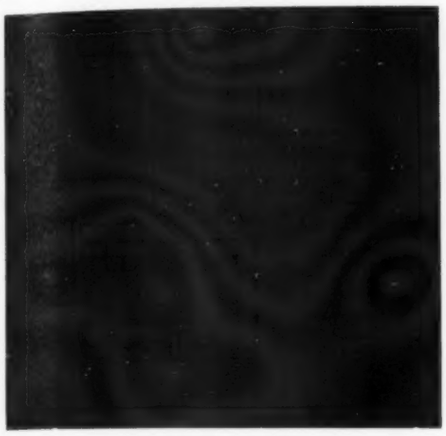
Willis Oil Tool Company

THE radically different design of the Willis Rotary Adjustable Flow Bean provides the advantages of both the solid and adjustable type beans without their disadvantages. This new approach to the old problem of regulating oil flow from a well eliminates many unnecessary and costly operations, such as closing off the flow and removing flanges to get at permanent beans or otherwise disturbing operation of the well, and maintains more accurate flow to keep allowable production with a 5 percent variation. Sturdy construction and straight, unobstructed orifices eliminate turbulence, reduce wear, prevent waxing and freezing, and lower operating costs. This device enables operators to know the exact size of opening in line of flow, without guesswork or attempting to compensate for ordinary needle valve and seat wear. An accurate, constant flow is obtained at all times by simply rotating the orifice carrier 60 degrees to the next larger or smaller opening, which will increase or decrease the flow as desired. This can be done against

Renewing orifices or changing size ranges in the Willis Flow Bean is simply a matter of unscrewing the inspection plug as shown.

high pressures without shutting down the well, even on one-arm Christmas trees, and a new bean is then in operation.

Six different sized orifices are provided in the Willis Flow Bean, and any one of these can be placed in line of flow with a fraction of a turn. The orifices can be easily renewed after long service without disturbing flow.



The cross-sectional drawing above shows construction and operating features of the Willis Flow Bean. (1) Cast steel body (two halves); (2) Rotating disc; (3) Rotating shaft; (4) Adjusting screw, to actuate pressure sealing; (5) Steel inspection plug; (6) Hardened and ground flow Bean, in position of flow and for inspection; (7) Hardened bushing which forms front seat for Bean; (8) Hardened bushing which forms back seat for Bean

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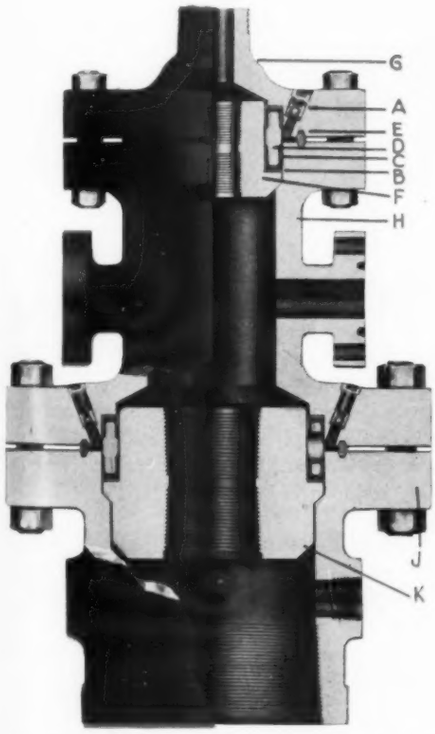
Atlas Engineering Works



Atlas A-5 Combination Tubing and Casting Head. A—Check Valve and Connection for Plastic Gun. B—Steel Ring; C—Composition Ring; D—Perforated Space Ring; E—Metal Seal Ring; F—Tubing Hanger; G—Tubing Head Bonnet; H—Tubing Head Body; J—Casing Head Body; K—Casing Head Hanger.

A NEWLY designed sealing medium now being offered the oil production industry, is the Atlas A-5 combination Tubing and Casing Head. This new equipment harnesses the well pressure in forming the seal. The seal can also be used on pressure connections other than oil wells.

The important features of the Atlas A-5 Tubing and Casing Heads is its simplicity and flexibility. The seal is composed of three rings, viz: a closely machined steel ring to back-up the composition ring; the composition ring, having two lips that seals against both body and hanger, and the perforated spacer ring that allows free passage of plastic compound throughout the seal. The plastic compound is introduced into the seal by a gun connected to the check valve, "A". While the plastic compound is used to form a positive seal, the well pressure will effect a seal also. When tubing pressure is greatest, seal-off is effected in the *lower* composition ring; when casing head pressure is greatest, seal-off is effected in the *topmost* seal ring. By use of the plastic compound, a test of the seal is made before pressure is allowed to contact the connection. The bonnets and bodies of both heads are made of materials suitable to withstand pressures of 1,000 to 10,000 pounds in popular sizes.

Diagram showing more clearly the details of the sealing feature of the Atlas combination tubing and casing head.

Hamer Oil Tool Co.

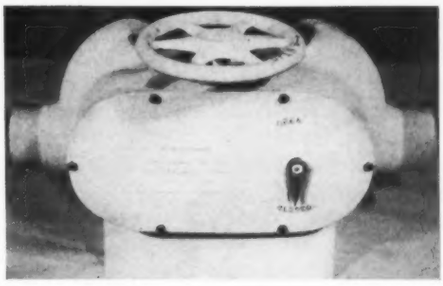


Figure 1

ONE of the new Hamer double-seal partition valves for refineries, gasoline plants and pipe lines replaces the two gate valves ordinarily used on either side of the common slip-bank blind. With a few turns of the hand wheel one man accomplishes the work of a whole blinding crew, and does it without spilling a drop.

The partition valve embodies two valve members which close against seats situated in the central partition of the body. The valve members are synchronized and raised or seated simultaneously through powerful worm gearing operated by the single hand wheel. The possibility of one valve member being left partly open, as often happens when two gate valves are used, is avoided. An external indicator shows whether the valve is open or closed, and a bleeder leading from the chamber between the seats in the partition gives a further check. The valve members swing to and away from the seats, eliminating "wire draw" which so frequently damages valves. They provide a double sealing action, having both metal-to-metal contact with the ground surfaces of the seats, and neoprene squeeze-tight pressure

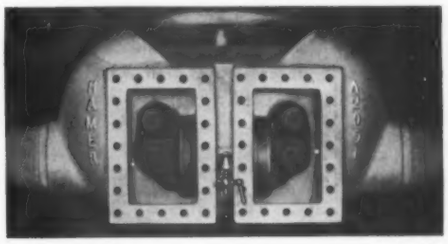


Figure 2

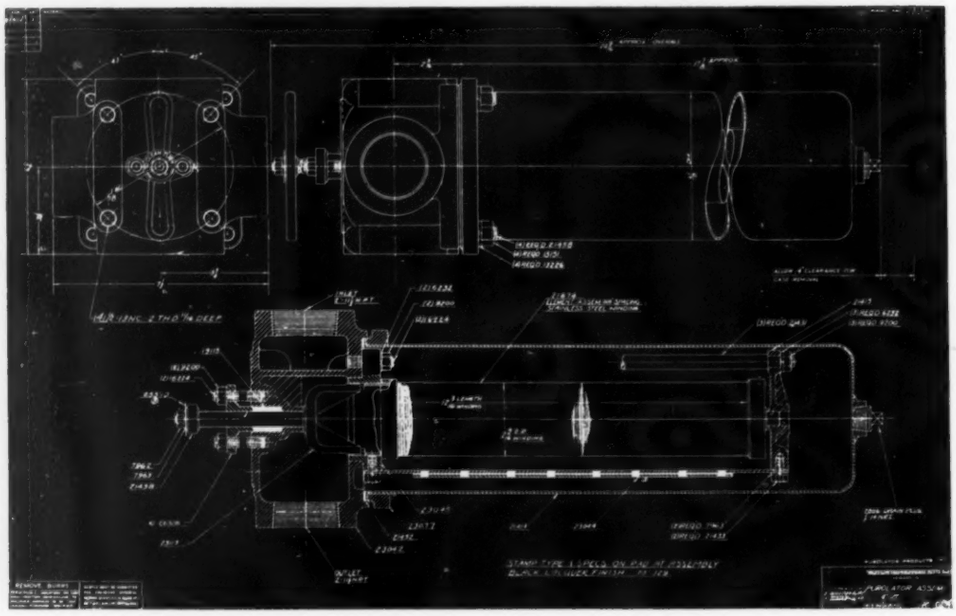
seals. The gearing permits quick, easy opening of the valve under pressure, and also insures tight contact of the valves and seats when the valve is closed. The partition valve can be installed in any desired position, and can be operated by remote control, such as extension rods or electric motor. It can be used at temperatures from below zero to 850° F.

The straight, full, round opening through the partition valve prevents undue erosion of the valve seats, and provides clearance for all line-cleaning devices such as spinners, scrapers, and swabs. The valve members are lifted and held completely out of the way while the valve is open.

Figure 1 shows the Hamer double-seal partitions valve ready for connecting in the line, one unit taking the place of two gate valves, one slip-blank blind, and other items such as flanges, bolts, bleeder valves, and small piping. It makes manifolds more compact, and saves much hard-to-get material.

Figure 2 shows the valve fully closed. Double sealing efficiency is provided by metal-to-metal contact of valve members with ground seats and squeeze-tight pressure seals.

PUROLATOR TYPE G-141J FILTER



THIS filter is designed for use in either the pressure or the suction line, where flow rates are constant or intermittent. It is adapted for installation on engines or machine tool equipment where large quantities of lubricating oil is necessary and for process work such as oils, greases, and so forth, where flow rates are limited.

Head and parts of the element are fabricated of cast iron. Head with either screw or flanged connections 2" I.P.S. Flanged connections are made up of short nipples with 125 lb. drilled or blank flanges. Relief valves are incorporated when so specified. Head and element have large free port areas allowing maximum flow with minimum pressure drop.

Stuffing box is easily accessible and of adequate design, size and depth. Sump is of drawn steel with large drain plug; element size 2 9/16" diameter x 12 3/6" length of winding; spacing from .001/ to .015".

Element is self-cleaning while filter is in operation. Element frame is of pierced steel shell type, allowing free open area and having exceptional strength.

Metal ribbon forming the filtering medium is made of bronze, monel, or stainless steel. Cleaning blades and other accessories are of steel and cast iron. Motor driven mechanism is optional.

Operating Pressures: Standard construction is suitable for 125 lb. gauge, maximum; temperatures up to 300 degrees F.

Approximate Weight—Hand Operated—37 lbs. Units of this same design can be had up to and including six-inch flange connections, all other parts being proportionately larger. This, of course, will lend itself to larger flow rates.

GOODYEAR TIRE & RUBBER COMPANY

CULMINATING several years of research and development, the Goodyear Tire & Rubber Company announce a new type of V-belt especially adapted for the motors of tanks and armored vehicles. Utilizing steel wires in place of the conventional fabric or cord carcasses, the belts are now being manufactured in volume for army equipment.

They provide increased strength, higher resistance to heat and far less stretch than preceding types. These factors are important because of the inaccesibility of fan belts and the tremendous amounts of heat developed by powerful motors in armored vehicles. Standard cotton cross section V-belts fail to stand up under this excessive heat; they stretch or burn out and cause the motors to overheat. And a soldier in combat, it may be pointed out, is unable to take time out to replace or adjust a burned-out or stretched fan belt.

With the development of the new endless steel-wire carcass belt and its greater strength, the field of multi drives on a single belt undoubtedly will be extended. This would mean, in the case of vehicle motors, more engine parts on a single belt in addition to the fan and generator.

In addition, they undoubtedly will be adapted for industrial uses on heavy duty drives which normally could not be handled by the standard cotton-carcass belt.

Already the same principle has been adapted to conveyor belting in what is believed to be the world's first commercial-sized conveyor with belting of this type. This belting is over 2,000 feet long and is destined for early application in the transportation of iron ore. It will mean the use of long units without the necessity of transfering from one belt to another.

NEW BUDA FIELD JACK

THE Buda Model 2215-S automatic-lowering jack is an ideal heavy-duty, all-weather, all purpose lifting tool designed for rig builders, truckers, tool pushers and oil field "rough-necks." This 15-ton jack is carefully engineered and field-tested, and meets the critical demands in oil field service for a tough, rugged jack that's easy to work, simple to move and set in position, capable of standing heavy loads and will last "one helluva long time" under the worst field conditions!

Special features of this jack include:

Large Extra-Heavy Base—with grooved bottom . . . provides firm footing for all loads.

Rugged, Husky Frame—stands up under roughest handling and exposure. Enclosed mechanism prevents dirt and rocks from entering and possibly jamming jack.

Easy Lift—Lifts on a series of short easy steps . . . no longer is it necessary to push on lever bar with back-breaking effort to lift heavy loads.

Simple Reversing Mechanism — operated by merely pushing with foot or lever bar.

Toe Lift—gets under low clearance . . . safely raises machinery, heavy loads.

Hinged Base—permits tilting of jack . . . especially desirable in setting and locating mud pumps in position, drilling rigs, etc.

Buda Model 2215-S, 15-ton automatic lowering "all purpose" jack with hinged-type frame, new reversing mechanism, extra large base and five-foot chain with two hooks.

Double Lever Socket—enables operator to choose the socket most convenient for him when raising or lowering loads.

Five-Foot Link Chain—with two hooks, broadens use of jack. Chain can be used independently for snagging, grappling, and for all types of unusual lifting jobs.

The Buda Company has been manufacturing quality lifting jacks for more than 30 years and today it has over 170 individual models in production.

✦

De Laval Steam Turbine Co.

A GREAT variety of motor-driven industrial equipment, such as mixers, dryers, automatic furnaces and ovens, churns, small conveyors and elevators, mechanical stokers, door openers, etc., requires only small power, but, as small electric motors run at high speeds, speed reducers are necessary.

The small worm gears here shown are produced by the De Laval Steam Turbine Company, Trenton, N. J., for ratios of 3⅝ to 1 up to 60 to 1 and in 3 inches and 3½ inches center distances. They are distinguished by having casings cast in one piece, the casting with side plates totally enclosing the working parts and serving as an oil reservoir from which the bearings and gear teeth are lubricated. The interior is accessible upon removing one of the side plates, although the only attention required is checking the oil level at long intervals, for which purpose a gage cock is provided. The worm shaft is carried on ball bearings and the wheel shaft on Timken bearings. The worm and worm shaft are of carburized nickel steel, heat treated after machining, while the worm wheel is of chill-cast bronze with hobbed teeth.

The units are supplied for either top or bottom drive, with shaft extension to either right or left, or in both directions. The lower ratios can be used as speed increasing gears up to a maximum speed of 2000 revolutions per minute.

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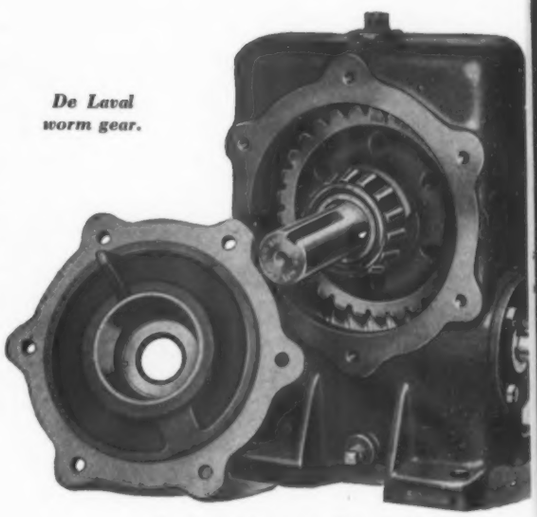


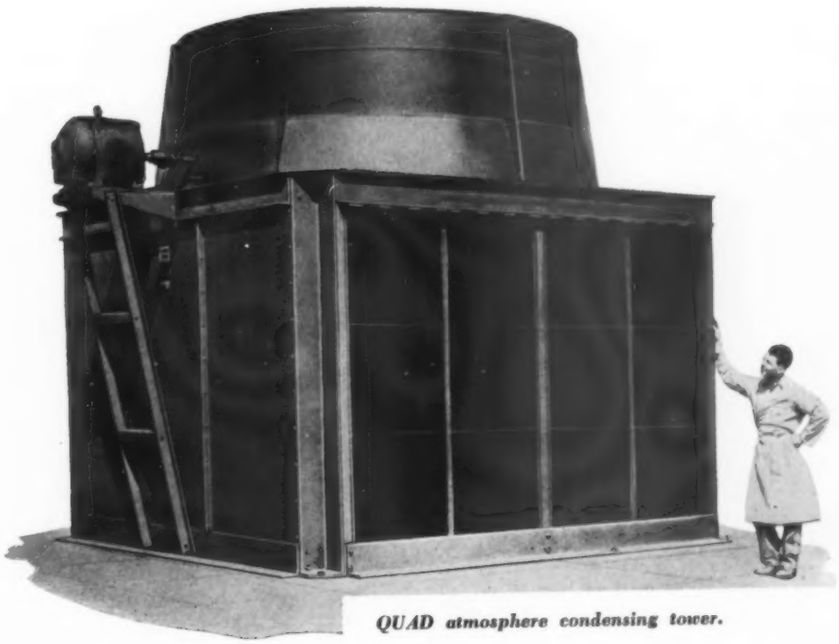
De Laval worm gear.

Bottom drive gear disassembled.

NEW YOUNG RADIATOR CO. PRODUCTS

AMONG its newest improved products the Young Radiator Company points especially to two major items. The first is their QUAD Atmospheric Condensing Tower (shown in the accompanying illustration) which can be supplied in models for condensing steam or other vapors or for cooling engine jacket water or similar liquids. The unit illustrated is a very large one, with a fan 10 feet in diameter. In the case of Atmospheric Cooling Towers provision is made for mounting an oil cooling coil in front of the standard water cooling core. The Model 743 cooling tower is capable of handling the heat rejection of both the engine jacket water and lub oil of the 2000 h.p. Diesel engine. Several oil companies are installing these units; in some cases they will be used in conjunction with standard oil refining processes, and in others in conjunction with the new synthetic rubber program. The improvements embodied in these units assure high efficiency in condensing or cooling.

The second major product announced by this company is the Young VERTIVENT Heater and Ventilator described in their Catalogs No. 2942 and No. 4524. This is a new type of heating and ventilating unit demanded especially by war plants having large floor spaces under one roof that have to be completely blacked out, and cannot be satisfactorily conditioned by window ventilation. The VERTIVENT takes fresh air from the outside, tempers it, and distributes uniformly throughout the space. It is well adapted to structures already erected and quickly installed.



QUAD atmosphere condensing tower.

McKISSICK'S NEW SNATCH BLOCK

THE latest McKissick snatch block to hit the production line is a snatch block, the principal feature of which is its design that permits threading while in suspension. This snatch block will be particularly advantageous for use in heavy trucking where a gin pole or crane is also in use. It is not necessary to take this block down for rethreading; by simply removing the locking pin, one of the side plates slides open, and the line may then be inserted and properly threaded.

The hook used on this block is heat treated forged steel which is flatted, for greater strength. The hook swings free on the cross member and also swivels, thereby alligning itself to direction of the pull without undue strain or bind. The unusually large center pin is shouldered and locked to the plates to insure free movement of the sheave under heavy loads. The two photos and drawing herewith show how it works and the simplicity of operation.

Compact, sturdy and extremely flexible, this new McKissick snatch block is made with side plates of 3/8 inch bar steel. The center pin is 2 inch in diameter and alemite lubricated.

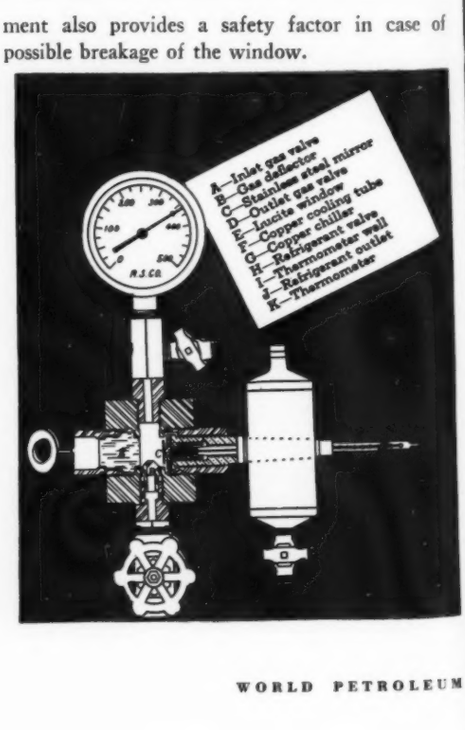
Another distinct advantage of these blocks is the interchangeability of bearings, sheave pins, connections and sheaves with respect to line grooving. Proper designing of sheaves and line grooving of all McKissick Blocks assures the ultimate in wire line economy. The McKissick Products Corporation's fifteen years of designing, developing and manufacturing of pulley blocks has resulted in greater safety, wider application with fewer designs, longer service and fewer replacements.

The Refinery Supply Co.

THIS company features its dewpoint tester, of the Bureau of Mines type, for gas under pressure. The principle of the operation includes:

(1) Cooling of a polished mirror surface, which is in contact with the flowing gas, to that temperature at which condensation begins, (2) direct visual observation of this condensate in the form of dew or frost on the mirror surface, and (3) observation of the temperature at which the deposit appears and disappears, as indicated by a thermometer. The unit is made principally of stainless steel to avoid corrosion by either condensed moisture or any corrosive gases that might be present. The apparatus is suitable for use at pressures up to 2,500 pounds per square inch, but is equally suitable for use at atmospheric pressure. It has withstood hydrostatic-pressure tests of 5,000 pounds per square inch. A suitable window permits direct visual observation of the mirror. This window, which must withstand the full gas pressure in the apparatus, is made of Lucite, a thermoplastic organic resin of sufficient strength and transparency for the purpose. As a test for suitability of the Lucite, the apparatus was given a 6-Hour sustained pressure test of 3,000 pounds per square inch at room temperature. The Lucite showed no signs of failure.

Referring to the sectional view, A is a shut-off valve and normally is left open while the apparatus is being operated. Valve D controls the rate of flow of gas through the apparatus. Gas entering through Valve A is directed by deflector B against the polished stainless steel mirror C and passed out through valve D. The appearance and disappearance of the dew or frost is observed through the window E. It has been found convenient to mount a mirror in front of the window at such an angle as to permit observation of the stainless-steel mirror within the apparatus from a position that will also permit convenient reading of the thermometer, which registers the mirror temperature. This arrangement also provides a safety factor in case of possible breakage of the window.



John Zink Burner Company

ACCORDING to information received, more than half of the furnaces operating or to be operated in the manufacture of synthetics for artificial rubber are fired by specially designed John Zink Burner Company burners.

In the ordinary course of manufacturing these synthetics the hydrocarbons which are to be converted are caused to flow through tubes which are arranged in the furnace so as to maintain nearly optimum rates of heat transfer to the material being treated. The tube arrangement provides nearly optimum heat transfer rates, but at times this arrangement is not satisfactory and it is necessary to provide additional means of controlling heat transfer rates in selected portions of the furnace. Provision of this means of control has presented a very aggravating problem to designers in the past. The essential parts of a Zink burner are: A floor thimble or mounting flange; secondary air dampers; a handle for adjusting the direction of heat projection; an air mixer, a radiating armed spider and an air shield. A damper for control of primary air is provided on the air mixer. Gas under pressures from five to twenty-five pounds is connected to the gas supply nipple on the air mixer. From the mixer, the gas is discharged through a limiting orifice directly up the center of a mixing nipple. The gas-air mixture thus produced is delivered to the radiating armed spider the arms of which are hollow. Ports are drilled in each of the arms of the spider to allow the gas-air mixture to flow into the combustion zone and burn. The flame as produced by this type of burner is extremely short to avoid the impingement of flame on tubes in the furnace.

The spider is so attached to the mixing tube as to incline the face of the spider at an angle of 30 degrees to the axis of the burner. Design of the burner is such that the entire mixer-mixing nipple-spider assembly may be rotated through 360 degrees. Therefore, the direction of heat flow away from the burner is substantially at 30 degrees to the axis of the burner in a radial direction. If the burner is set in such a manner that too much heat is being placed at a certain point in the furnace, it is only necessary for the operator to turn the face of the spider away from that point until the condition of excessive heat has been relieved.

Where more than one burner is being used, especially in vertical cylindrical furnaces, extremely close control of furnace temperatures is possible. The same is true of rectangular furnaces but perhaps to a lesser degree.

Where oil is to be burned in combination with gas, provision for insertion of the oil burner through the center of the burner assembly has been made.

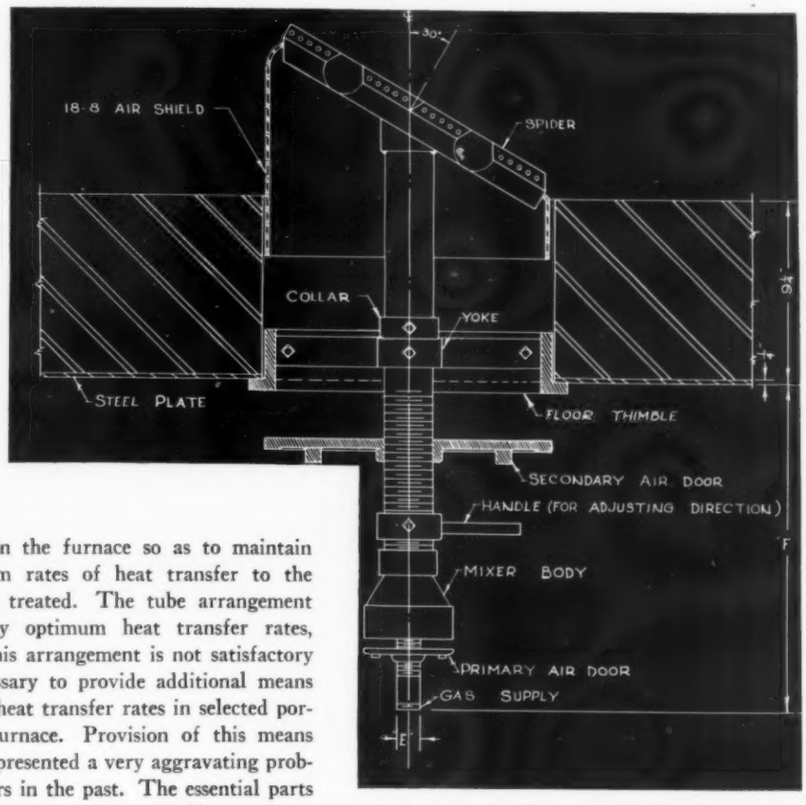


Diagram showing essential parts of a Zink burner.

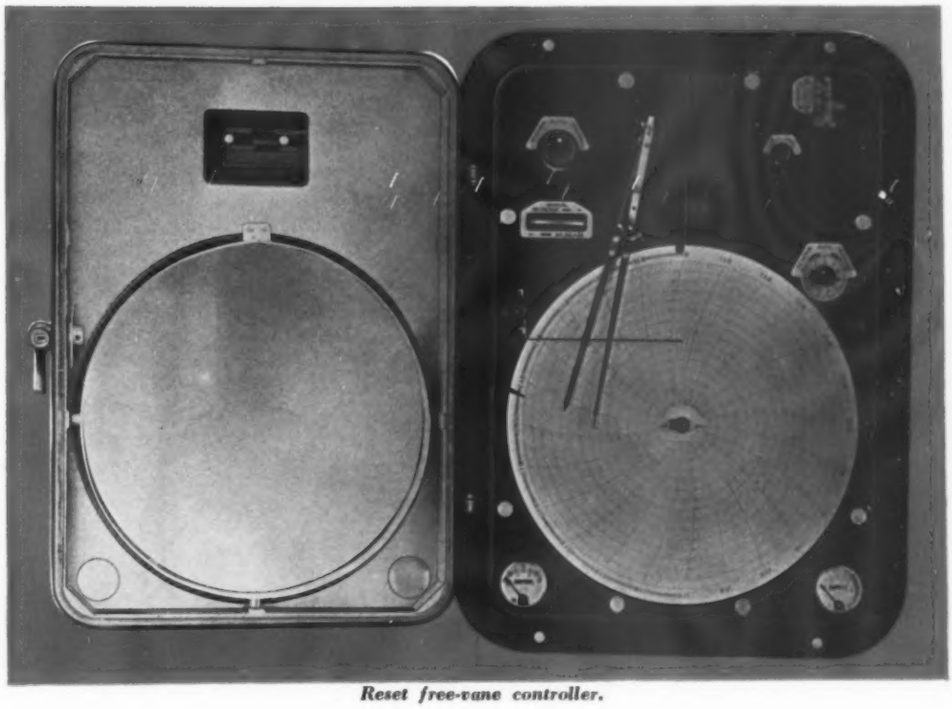
✦

Bristol Developes New Air-Operated Controller

A NEW air-operated automatic control instrument, known as Convertible Free-Vane Controller, has just been announced by The Bristol Company, Waterbury, Connecticut. The new instrument is made for automatically controlling temperature (up to 3600°F.) flow, liquid level, pressure, draft, humidity, pH value, and time program.

The Convertible Free-Vane Controller operates on the same basic free-vane principle as that used in previous models offered by the company. In the Convertible-Type Controller a number of design refinements have been incorporated, which simplify the instrument and make it more convenient to service. The new instrument is also designed so that the user can convert from one type of control system to another. The adjustments for fitting the controller to the requirements of the process are located on a dial board above the chart.

The Convertible Air-Operated Controller is offered in the following types: Monoset (On and Off), Ampliset (Throttling), Preset, Reset, and Magniset.



Reset free-vane controller.

Moore Jackknife Cantilever Mast

THE Moore Jackknife Cantilever Mast has made it possible for many drilling contractors and operators to "modernize" their drilling equipment at minimum cost. Every well has its "overhead" in the form of transportation, rig-building, rigging-up, foundations and dismantling. The reduction or elimination of this expense may well mean the difference between a profit and loss on each drilling operation. Any standard unitized draw-works, rotary and power can be used with a Jackknife Cantilever Mast and base. The mast is complete in every detail and the permanent mounting of crown blocks, ladders, platforms, catline sheave, etc., contribute to its economy of operation.

The principal features of this mast are: a highly portable rotary drilling mast of proven advantages; a self-supporting mast that is raised easily and quickly to the operating position by the draw-works, and which completely services every purpose of the ordinary drilling derrick; it is complete in every detail so as to reduce to an absolute minimum the time required for rigging-up, and its construction is rugged to make it withstand the abuse of fast handling as well as to withstand the most severe operating loads and conditions. Each side is made of the minimum number of welded steel sections with the minimum number of field assembly bolts to speed up erecting and dismantling of the mast.

The unit is complete with heavy skid type steel base which folds to a size to meet highway clearance regulations and merely unfolds to provide support for the mast, rotary table, draw-works and power. The base consists mainly of two welded sections hinged together so that after unfolding it can be quickly leveled up for attachment of the mast. A removable spreader in the front end of the base makes it possible to skid the unit away from the well without jacking it up to clear connections.

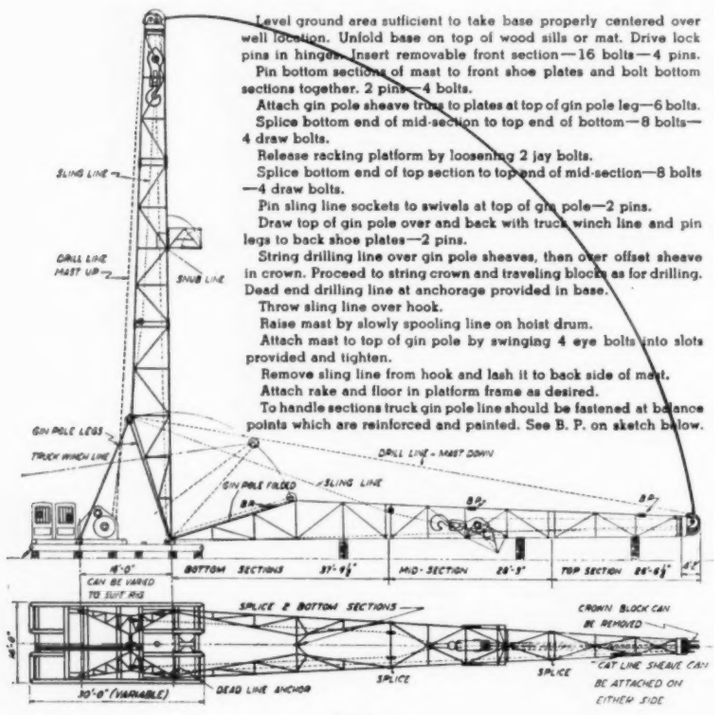

Level ground area sufficient to take base properly centered over well location. Unfold base on top of wood sills or mat. Drive lock pins in hinges. Insert removable front section—16 bolts—4 pins.
Pin bottom sections of mast to front shoe plates and bolt bottom sections together. 2 pins—4 bolts.
Attach gin pole sheave truss to plates at top of gin pole leg—6 bolts.
Splice bottom end of mid-section to top end of bottom—8 bolts—4 draw bolts.
Release racking platform by loosening 2 jay bolts.
Splice bottom end of top section to top end of mid-section—8 bolts—4 draw bolts.
Pin sling line sockets to swivels at top of gin pole—2 pins.
Draw top of gin pole over and back with truck winch line and pin legs to back shoe plates—2 pins.
String drilling line over gin pole sheaves, then over offset sheave in crown. Proceed to string crown and traveling blocks as for drilling. Dead end drilling line at anchorage provided in base.
Throw sling line over hook.
Raise mast by slowly spooling line on hoist drum.
Attach mast to top of gin pole by swinging 4 eye bolts into slots provided and tighten.
Remove sling line from hook and lash it to back side of mast.
Attach rake and floor in platform frame as desired.
To handle sections truck gin pole line should be fastened at balance points which are reinforced and painted. See B. P. on sketch below.
SLING LINE
DRILL LINE MAST UP
SNUB LINE
GIN POLE LEGS
TRUCK WINCH LINE
DRILL LINE - MAST DOWN
GIN POLE FOLDED
SLING LINE
BOTTOM SECTIONS
MID-SECTION
TOP SECTION
CAN BE VARIED TO SUIT RIG
SPLICE 2 BOTTOM SECTIONS
CROWN BLOCK CAN BE REMOVED
SPLICE
SPLICE
CAT LINE SHEAVE CAN BE ATTACHED ON EITHER SIDE
30'-0" (VARIABLE)
DEAD LINE ANCHOR

FIG. 3

Left: Fig. 1, outlining procedure for assembling and raising the mast.

Below: Fig. 2, sub-base for Jackknife mast.

Four mast sizes are standard: the 62, the 87, the 94 and the 126. Specifications of each are given in the accompanying table. The 94 and the 126 are series masts which can be converted from one size to the other by the addition or subtraction of one 32-foot section.

Figure 1 outlines the procedure for assembling and raising the 87-foot mast. The other sizes are handled in a similar manner. As noted the sections are assembled horizontally on the ground. The drilling line is strung up in the regular manner and the mast is then raised by the traveling block and hook attached to a sling line built into the mast. This is an important feature because, when the mast is raised, the block is ready for drilling. After the traveling block has been strung up at the first location it need not be removed from the mast for future moves.

The sub-bases for the Jackknife Cantilever Masts provide a means of elevating the mast base to give the required clearance under the base for the necessary well head connections. These sub-bases can be made in various heights to suit the clearance requirements.

Type 1, has the interior skids on 4′ or 4′8″ centers and type 2, has the interior skids on 11′ centers to provide clearance for a 10′ wide cellar. These two types are considered standard but other special types more adaptable to the operators equipment are available.

All of the sub-bases are designed so that after the first installation a minimum amount of dismantling and re-assemblin is necessary for moves. When the two halves are disconnected by the removal of one or two cross ties they will be of such size to permit highway transportation.

✦

Dowell Inc.

Dowell Electric Pilot

DOWELL INCORPORATED has recently placed in the field an apparatus known as the Electric Pilot, which can be used (1) to control the introduction of acidizing chemicals into selected zones and (2) to determine the relative permeability of various zones in a well bore.

The instrument is in actuality an electrical fluid interface locator, the electrical circuit of which is completed when the electrodes are in contact with a conductive fluid, such as acid or salt water, A diagrammatic sketch of how the electrode unit is constructed is given in Figure 1. In some applications the interface locator is run inside the tubing, and in others it is run in the casing and open hole with no tubing in the well.

Actual operation of the interface locator is most easily understood by referring to Figure 2. In the three illustrations of this figure, the electrodes are shown completely immersed in oil; immersed half in oil and half in acid, and completely immersed in acid. Each of the illustrations shows the electrode unit connected with a battery (B) and an ammeter (A) and also shown are the ammeter readings which would be indicated under each of these three conditions which are possible at the bottom of the hole during use.

A schematic diagram of the surface equipment used with the interface locating unit is shown in Figure 3. This consists of a power driven reel for spooling the insulated cable with a measure meter and weight indicator installed on the line near the reel. Operating current for the unit is supplied by a small alternating current generator connected to a transformer. An ammeter in the circuit shows the amount of current flowing when the electrode unit (interface locator) is lowered to the bottom of the well and under bottom hold conditions as described above. All of this equipment is mounted in a light panel truck for commercial field service use.

✦

Industrial Cleaning by Chemical Methods

SCALE or sludge accumulations deposited in boilers, condensers and other types of heat exchange equipment is now being safely removed in a fraction of the time formerly required.

The service is offered by Dowell Incorporated, Tulsa, Oklahoma, through their stations located in many sections of the United States. The process is to test samples of the scale accumulations by x-ray and chemical analysis then transport the proper formulæ of solvent to the unit to be cleaned in specially designed pump and tank trucks—fill the vessel completely and remove the incrustations by special application of the solvent in the unit. The work is directed by personnel especially trained in this service.

The savings offered by shorter down time is considerable. Boilers can be cleaned in as little as ten hours without disturbing the installation. A condenser with fifteen miles of ¾″ tubing, for example, was thoroughly cleaned in two hours. The service is also very effective in cleaning water lines, sewers, preheaters, bubble towers, coolers, etc.

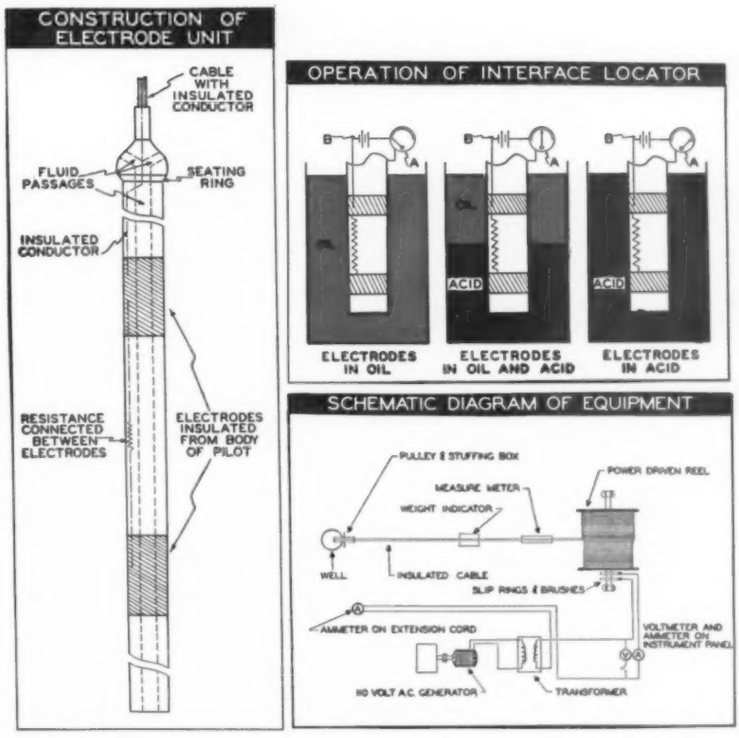


Fig. 2.

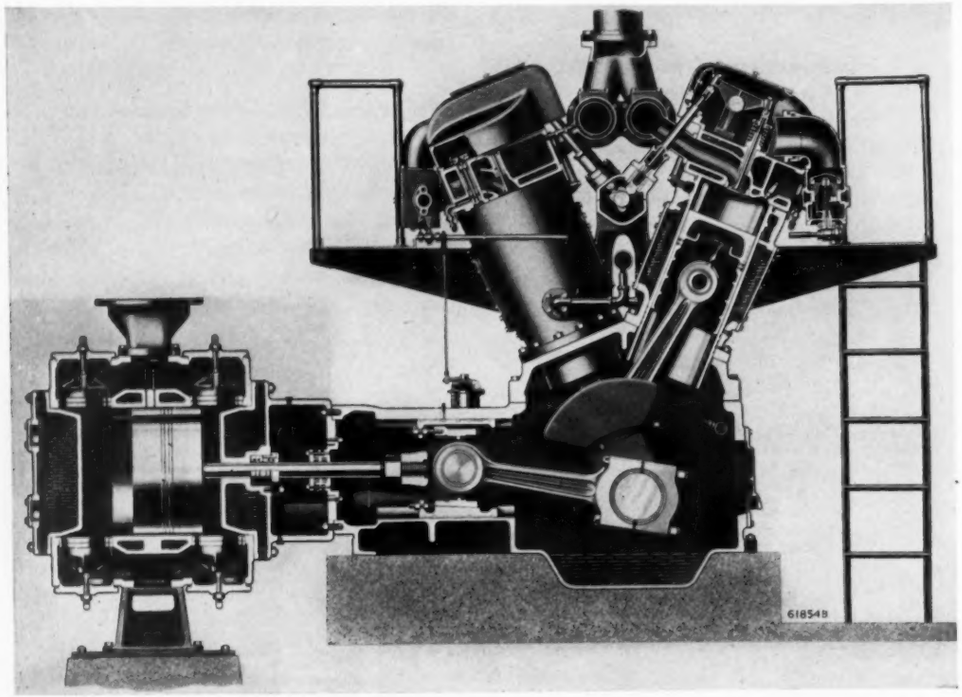
Fig. 3.

Fig. 1.

Dowell especially designed truck for their industrial cleaning service.

Ingersoll-Rand Engine Driven Compressor and Gas Engine

THE 600 and 880 hp. Type KVG gas engine driven compressors, and the corresponding size of PKVG gas engines are the latest "V"-angle units of this type brought out by the Ingersoll-Rand Company, which company originated this "V"-angle design in 1931. While released less than two years ago, close to 100,000 hp. of the KVG type of machine are either in operation or building for service in synthetic rubber and aviation plants, or for use in other important processes.



Ingersoll-Rand Type KVG gas engine driven compressor.

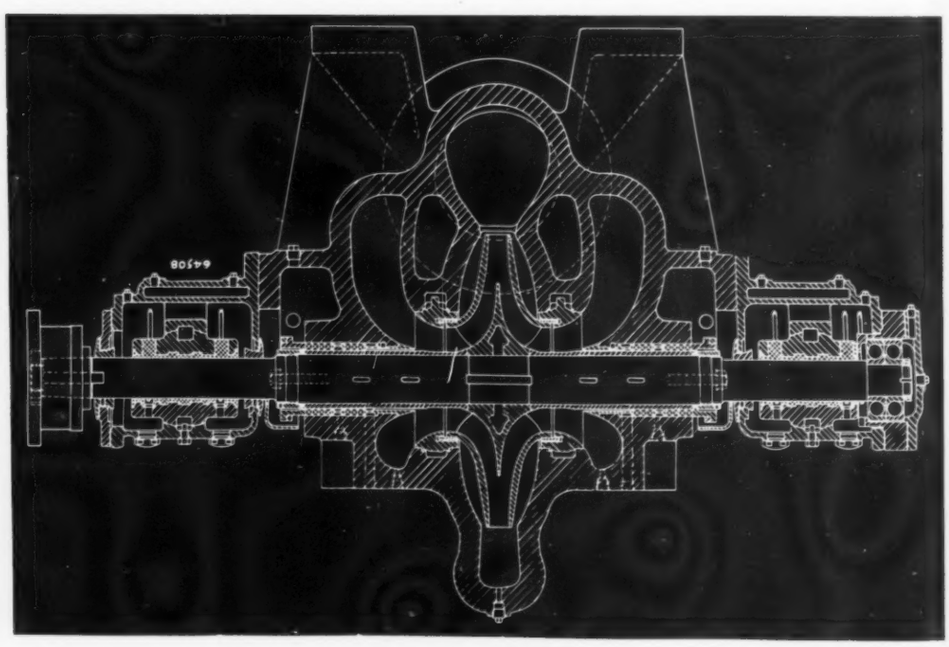
Among the outstanding features of these machines are:

1. Four-cycle design, with its inherent simplicity and ability to operate equally well at any load between no load and full load, and adaptability to automatic speed and pressure control between full and half speed.

2. "V" type engine design reducing number of cranks, length of crankshaft and engine, and eliminating any objectional torsional vibration up to and above the rated speed of the engines.

3. Removable liners in the power cylinders, which reduce wear and permit control of the water flow through the cylinder jackets, and afford easy and cheap replacement in case of necessity.

4. Separate cranks for the compressor connecting rods, allowing different crank throws to be used for the engine and the compressor in order to obtain the most desirable piston speed for the engine as well as for the compressor. The use of only two compressor cylinders reduces the number of stuffing boxes and other working parts, and also simplifies the inlet, discharge, and interstage piping and manifolding. Standard compressor cylinders are available for all commercial pressures and can be furnished in cast-iron, cast-steel, or forged steel, depending upon the operating conditions.



5. Simple and inexpensive engine piping, since each engine has only one air intake and one exhaust pipe, both being of comparatively small size and conveniently located.

The accompanying illustrations give a very complete picture of the construction of these machines. It will be noted that unusual care has been taken to provide a unit which will be easy to install, easy to pipe up, and easy to maintain. All important wearing parts are replaceable. Particular attention has been paid to accessibility and the location of all controls.

The engines are rated at 100 hp. per cylinder, there being six cylinders for the 600 hp. size and eight cylinders for the 800 hp. size. The two banks of power cylinders are at an angle of 45 degrees; each pair of cylinders in the "V" has the two connecting rods side by side on one and the same crank pin. When the unit is furnished as a compressor, separate cranks are provided on the crankshaft for the compressor connecting rods, and compressor frames are cast integral with the engine frame. On the power unit—the PKVG—the compressor frames and cranks are omitted, and the drive is arranged in the conventional way from the end of the crankshaft. This power unit, known as the Type PKVG gas engine, is a rugged, compact, and short engine, using the minimum space per horsepower for a heavy-duty engine.

Herein follows a brief description of the machines:

The frame and the frame top are each cast as a single piece. These are of the rigid box girder type with large inspection doors. A single piece, large diameter, stiff, crankshaft is used, and the main and crank pin bearings are of the steel shell, centrifugally babbitted type, with shim adjustments. All connecting rods are of forged steel and of the marine type.

The gas engine or power cylinders, which are individual castings, are provided with removable liners, having synthetic rubber packing rings and

tell-tale connections at the bottom. Pistons have full floating wrist pins and are oil-cooled.

The camshaft is enclosed in an oil and dust tight case and is located directly above the engine crankshaft in the "V" between the engine cylinders and directly above the crankshaft. The camshaft is driven by a heavy-duty adjustable roller chain from the flywheel end of the crankshaft. All valve guides, exhaust valve seats, and camshaft bearings are removable.

Each bank of power cylinders has its own intake header and mixing valve, and there is an ingenious arrangement for balancing the load between the two banks. Single main intake and exhaust connections are furnished, which makes for simplification of the plant piping.

All engine working parts are lubricated by the force-feed system and adequate lubricating oil filters and coolers are provided. Compressor cylinders and stuffing boxes have separate adjustable force-feed lubrication.

The KVG employs the same proven air starting system that has been widely used by the builder on other models of oil and gas engines. This consists of a revolving disk type distributor direct driven by the camshaft. It provides pneumatic control for the operation of the combined check and relief valves in each cylinder head. When the engine must be barred over, all relief valves are opened pneumatically and simultaneously by means of a hand control valve. Check valves can be easily removed for servicing.

✦

Grizzly Rotary Brake Blocks

By means of larger presses of 1,000 hydraulic pressure, Grizzly Manufacturing Company of Los Angeles, California, now are making rotary brake blocks of far greater density than previously has been possible. Also, through more than 25 years of specialized experience in the manufacture of brake blocks and brake lining materials for the petroleum and automotive industries, the company has developed a method of curvature, or radius, control during the process of curing in precision controlled ovens that insures perfect contact of the blocks on the drum for which they are specified.

These improvements in turn are resulting in unusual performance records in the field, much better than heretofore. Higher efficiencies are obtained, with smoother operating brakes that hold the load safely at any depth, and give longer wear, without smoking or dusting.

Grizzly Blocks are compressed under 1,000 tons of hydraulic pressure, forming an exceptionally hard, homogenuous mass of material that holds its density until the block is completely worn out. In tests, these blocks frequently have been subjected to as high as 2,000 of direct flame without showing any sign of disintegration. During manufacture, the material is impregnated with a special lubricant that gives the block a highly polished rim surface, much smoother than glass, which cannot score the drum, and therefore, saves vitally essential steel.

Grizzly Blocks are precision made to manufacturers' exact specifications of all types of drawworks to fit all types of brakes and all standard drum diameters.

Grizzly Pressure-Seal Rotary Hose

Continuous development and close contact with the various oil fields throughout the country, also has enabled Grizzly Manufacturing Company to perfect a rotary hose and coupling that gives full flow of fluid throughout the entire length of the hose, and eliminates the usual coupling troubles as well as leaks and hose failures.

Grizzly Pressure-Seal Rotary Hose is steel armored over its entire length and diameter by a recently improved method; the Grizzly Pressure-Seal Coupling being built integral with the hose in such a manner that it is impossible for the coupling to pull out or blow out, or for leaks to develop, even under extreme pressures not usually encountered in drilling operations.

The coupling incorporates a new method of sealing off the fluid; the seal being formed by the fluid within the hose. Figure 2 shows the detail of construction of this fluid seal. Seepage of fluid under pressure into the clearance between the coupling flange and the adapter at "a" and "b", forces the specially designed terminal of the hose body "c" firmly against the solid wall of the adapter at "d" and into the recess in the flange at "e"; thus forming a positive seal even at pressures that are practically nil, while higher pressures serve to strengthen this seal.

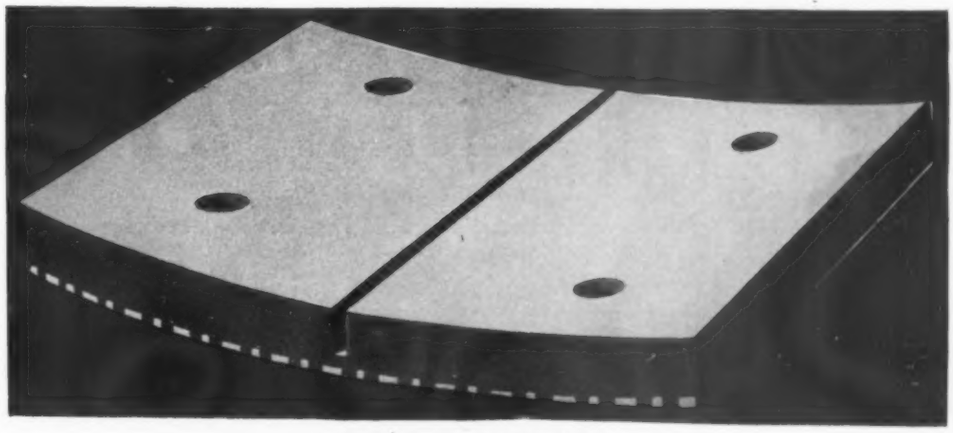


Figure 1. Rotary brake block.

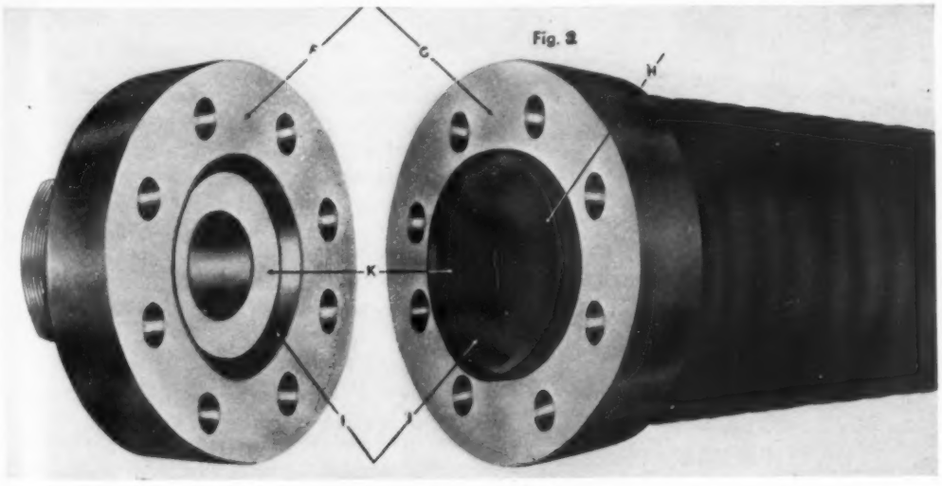


Figure 2. Pressure-seal rotary hose.

The steel-to-steel construction of the adapter "F" and coupling "G" does away with bending, clamping, or pinching of the hose in any manner. Both the adapter and the coupling flange are precision machined to a perfect fit when assembled, and are held securely in place by eight large bolts, so that no tightening ever is required at this connection. The adapter is recessed (I) to accommodate the end of the hose body (J), which protrudes ¾" beyond the face of the coupling flange. The fit of the hose against the recessed wall of the adapter at (K) is equivalent to average thumb-pressure, allowing fluid under minimum pressure to enter the V-shaped groove (H) and form a perfect seal.

EMSCO DERRICK AND EQUIPMENT CO.

Emsco Bulge Type Derrick

THE Bulge Type Derrick manufactured by Emsco Derrick & Equipment Company is an innovation in derrick design, the result of several years of development and field-proving to meet the demands of deeper drilling practice.

Deeper wells involve longer strings of pipe, also larger and heavier equipment, materially reducing the available space around the upper end of the racked pipe in standard rigs. The bulge type derrick with its special "set-back extension" fully meets this requirement, allowing from 33⅓ percent to 50 percent greater pipe racking capacity than with a conventional set-up, without resorting to additional height. The extended bracing which accommodates this additional pipe is illustrated by the red section on Figure 1; while the amount of extra pipe that may be racked in this derrick is shown in Figure 2. Required additions to both new derricks and derricks in the field, are shown by Figures 3 and 4.

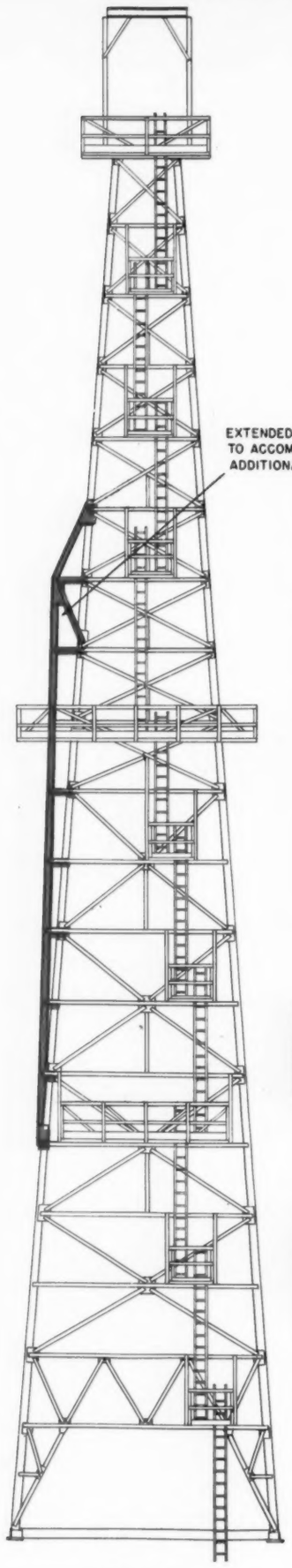


Figure 1

Figure 2

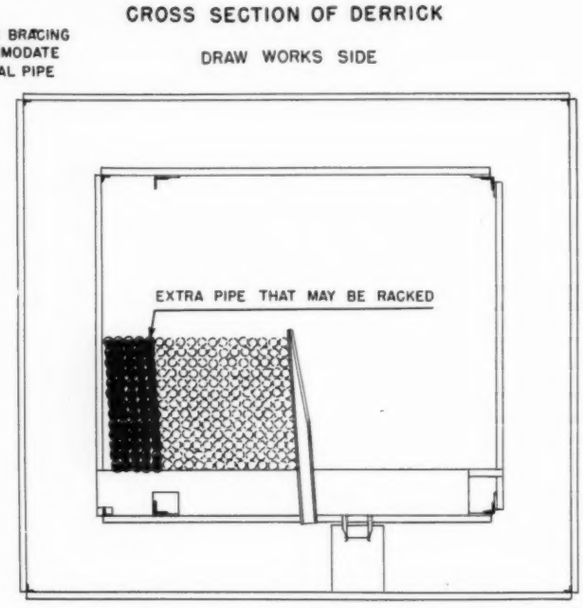


Figure 3

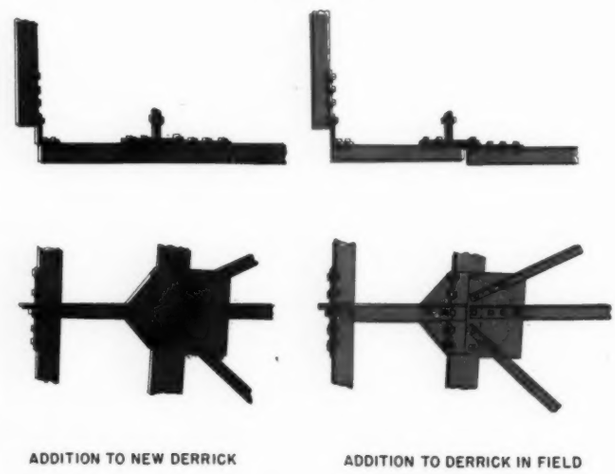


Figure 4

EMSCO

BULGE TYPE DERRICK

This much needed Emsco development has met with great favor among drillers, and offers many important advantages in deep drilling operations. It has been thoroughly proved by extensive usage in actual drilling service. The derrick bracing is strong and rigid, yet quickly and easily erected; and is exceptionally efficient in carrying load stresses to the foundation. It accomplishes all that derrick bracing is intended to and, in addition, provides support for erection purposes without requiring special girts. Working platforms are supplied at desired levels, with or without steel flooring. The V-window is firmly braced with a horizontal channel at the head of the V, which counteracts the natural tendency of the girt to deflect inward when using the cat line for pulling heavy loads from the casing rack.

Servicing and Care of Emsco Power Slush Pumps

With existing restrictions on all types of vital materials and equipment, the following suggestions relative to the servicing and care of slush pumps submitted by Emsco Derrick & Equipment Company will prove valuable in securing better and longer service from this type of equipment.

Starting Your Emsco Power Slush Pump:

1. Check all bolts and nuts to make certain they are tight.
2. Check the pump alignment with the motor.
3. Check the oil level.
4. Slowly turn the pump over, at least once, to make sure all parts are free.
5. Start and operate the pump with a low discharge pressure, and check for fluid and oil leaks.
6. Check the suction line for air leaks.
7. Increase the pump speed until the probable maximum working pressure is reached, and recheck for any leaks.
8. Should any leaks show up, stop the pump, tighten up, restart, and reinspect.

Each pump has been thoroughly tested and operated under maximum load before leaving the plant. No "break-in" period is necessary due to the extensive use of roller bearings. Normal care and judgment is all that is required to place the pump in operation and to keep it running satisfactorily.

Operation of Emsco Power Slush Pumps

The plate on each pump gives its size; therefore, be governed by the chart supplied with the pump.

The data on this chart must be considered as maximum operating conditions if the pump is to give its best service. If the conditions as set

forth in the chart are exceeded, a shorter life and unnecessary repair bills may result.

However, the pump is capable of operation in excess of the chart figures when two pumps are compounded. The limiting factors under these conditions are: the maximum working pressure of the fluid end (given on chart), and maximum permissible brake horsepower input.

Common Pump Troubles and Their Remedies

Loss or Lack of Discharge Pressure: 1. Pump not primed. It is good practice to manually prime a pump before putting it into operation. 2. Check suction line flanges and all connections for air leaks. 3. Check suction strainer if used. 4. In extremely sandy conditions, the suction should be taken loose and checked for an accumulation of sand which would obstruct the fluid passage. 5. Check all valves and seats for obstructions and see that they seat properly. Also check for an accumulation of sticks and other foreign matter in the manifold. 6. Check valve seat bushings, making sure that they are not battered and sticking the valves. 7. If an extremely long suction line is used, remove the springs from the suction valves. (This should be done only if it corrects the condition, and not as regular practice.) 8. Water course holes in bit may be washed out or be too large. 9. Check piston rubbers for wear or wash-by.

Excessive Discharge Pressure: 1. Pump handling excessive volume of fluid for size of drill pipe. 2. Water courses in bit may be too small. 3. Check for obstructions in drill pipe.

Insufficient Pump Speed: 1. Check for v-belt or clutch slippage of engine drive. 2. Engine not developing sufficient horsepower. 3. Excessive discharge pressure.

Heating: 1. The primary cause of heating is incorrect lubrication. See the lubrication instructions on the name plate of your pump, or supplied in manual form, for the correct weight and grade of oil. 2. Check the oil level. 3. Unless heat is centralized in one particular part of the pump, no alarm need be felt.

Fluid Knocks: 1. Open release valve and run pump free of pressure until a steady discharge is obtained. This will release air that is trapped in the pump, and make sure it is primed. 2. Check for bad valves and seats, which will make the pump miss and have a fluid knock. 3. If a long suction is used, a suction chamber should be used on it to give a better fluid fill-up on each stroke. 4. Make sure that piston rods are completely made up in the extension rods and are not striking the liner lock cages.

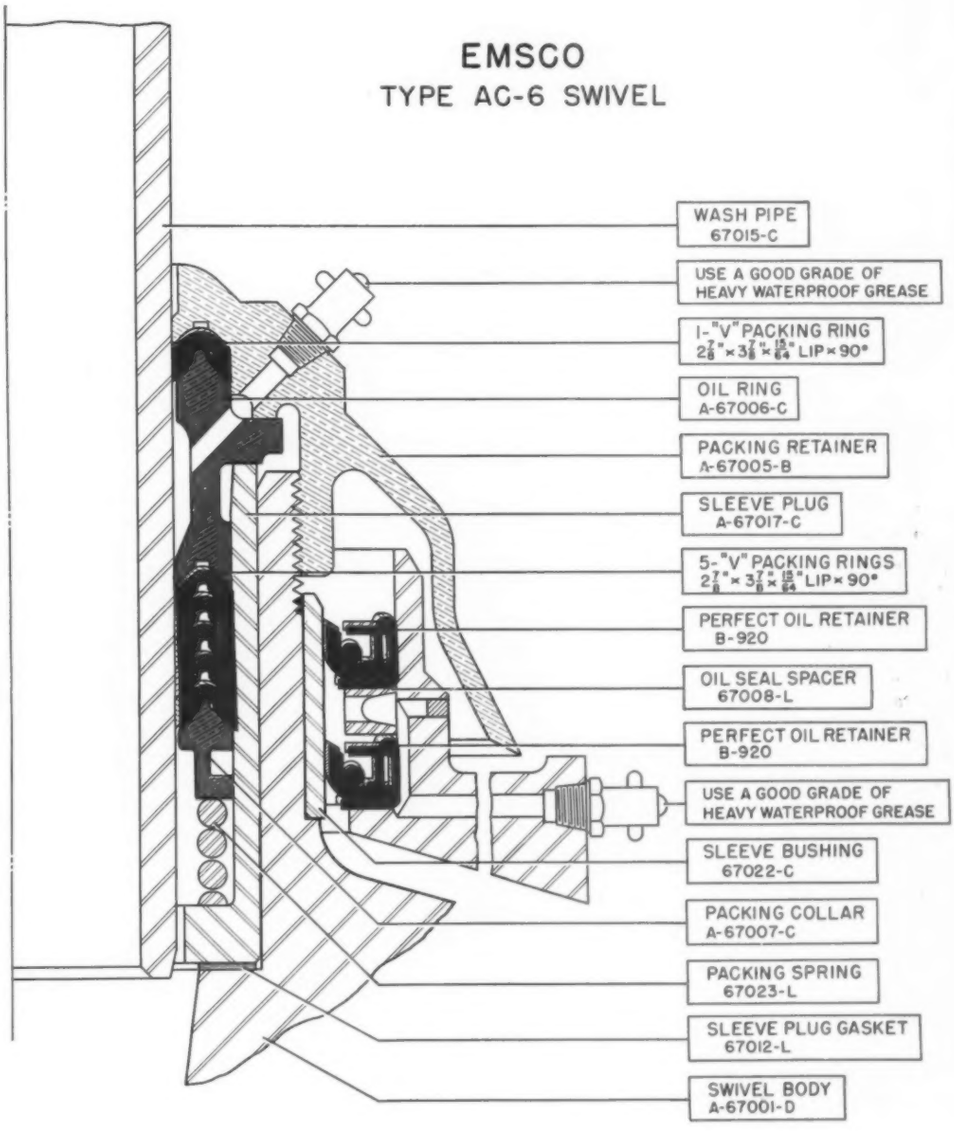
Maintenance and Care of Emsco Swivels

The swivel in an oil rig frequently must carry the weight of the entire drilling string, withstanding the additional strains of bouncing, and sometimes, even the abuse of jarring and excessive speeds. The main bearing, necessarily limited in size, receives the full force of this severe service. It is important in order to insure maximum service life, therefore, that good swivels be used in the first place, and that they be given proper care.

General precautions that insure better performance and longer life:

1. Before placing a swivel in service, be sure it is filled to the proper level with the correct lubricant.
2. Always make sure the swivel is running with the correct amount of clean oil.
3. Inspect frequently to insure that swivel is properly packed at all times.
4. Keep it perfectly clean around the washpipe compartment.
5. The washpipe and washpipe packing are the fastest wearing parts of any swivel, so do not run either one too long, or costly repairs are sure to result.
6. Clean the swivel out thoroughly with a good grade of flushing oil at regular intervals, and refill in the proper manner.
7. Do not over-load or over-speed. When operated properly under loads within rated capacities, swivels have been known to give satisfactory service for many years; while a swivel that is overloaded will fail prematurely. Select the right swivel for the job, and follow the manufacturer's instructions for care and operation.
8. Do not wait until the swivel fails before inspecting it for wear. It pays to make frequent inspections and replacements of all worn parts.

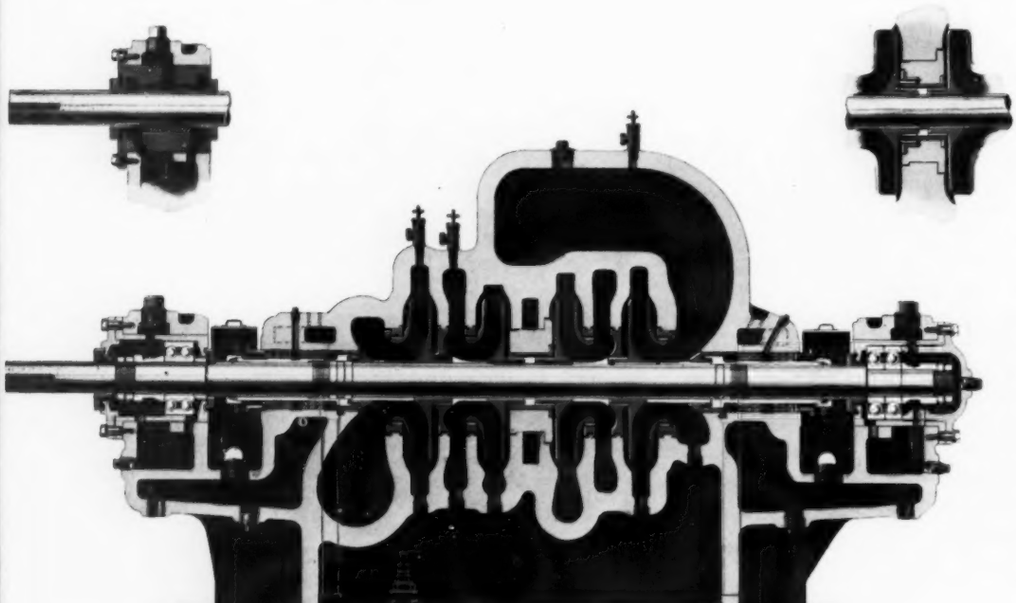
The accompanying illustration shows only the Emsco Type "AC-6" Swivel, and therefore, should not be used as a guide for all types of Emsco Swivels. The swivel should be flushed out with kerosene and filled with new oil at the start of each new well, or more frequently if the oil starts to thicken. Extreme pressure lubricant is recommended, either SAE 140 or 160. Grease sleeve upper oil seals through the Alemite fitting in the housing cover, using heavy-proof grease the same as used for wash pipe packing.


EMSCO
TYPE AC-6 SWIVEL
WASH PIPE 67015-C
USE A GOOD GRADE OF HEAVY WATERPROOF GREASE
1-"V" PACKING RING 2 7/8" × 3 3/8" × 15/64" LIP × 90°
OIL RING A-67006-C
PACKING RETAINER A-67005-B
SLEEVE PLUG A-67017-C
5-"V" PACKING RINGS 2 7/8" × 3 3/8" × 15/64" LIP × 90°
PERFECT OIL RETAINER B-920
OIL SEAL SPACER 67008-L
PERFECT OIL RETAINER B-920
USE A GOOD GRADE OF HEAVY WATERPROOF GREASE
SLEEVE BUSHING 67022-C
PACKING COLLAR A-67007-C
PACKING SPRING 67023-L
SLEEVE PLUG GASKET 67012-L
SWIVEL BODY A-67001-D
REF 67000-D

Goulds Pumps, Inc.

THE Goulds high pressure centrifugal pump for pipe line service that is shown in the accompanying illustration is designed for the severe, heavy duty, 24-hour per day service required for oil and gasoline pipe line installations.

The pump here illustrated is No. 3360; this picture shows the integral cross-over construction as used on 4 inch—6 and 8 stage and 6 inch—6 and 8 stage pumps; all other sizes have external cross-over connections. This design, along with another design (No. 3365) is offered by this company as providing the best possible operation for any service condition. The necessity of two designs is that one standard design for all the ratings encountered in pipe line service would limit the effectiveness and efficiency for some of the ratings, if an attempt is made to provide broad coverage with one design.



Sectional view, Fig. 3360, standard fitted construction.

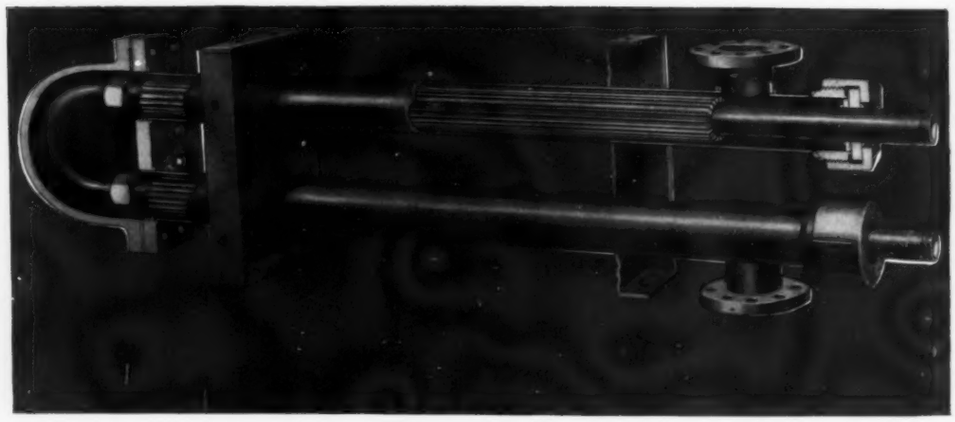
The essential difference between these two designs is in the type and arrangement of the impellers. In No. 3360 (the one pictured) there are two or more single side impellers opposed to an equal number of the same type. The other (No. 3365) has one double suction impeller with a pair of opposed single suction impellers. Both arrangements provide hydraulic balance and eliminate the need for complicated balancing devices or special mechanical thrust bearings.

These high pressure pumps are furnished for direct connected electric motor or steam turbine drive; or, through step-up gearing, they are readily adapted for diesel engine drive. Parts subject to wear are interchangeable and easily renewed.

✦

Brown Fintube Heat Exchangers

THE Brown Fintube Company, Elyria, Ohio, has arranged to build and sell complete ready-to-use heat exchangers for the duration, as a service to buyers who are unable, in the present rush of war work, to get needed equipment from their usual sources of supply. The Company will build these Fintube Heat Exchangers (see illustration) in all standard types and in any desired capacity to meet practically any cooling or cooling requirements. Brown Fintubes consist of commercial pipe or tubing to which longitudinal U-shaped formed steel channels have been resistance-welded onto the outside, using machines that have been designed and built specially for this service. The result is a strong one-piece Fintube having an integral bond of metal between the fins and central member. This proven, exclusive and integral construction assures high thermal efficiency, since it permits heat to flow freely between the fins and central member, without having to pass through an air gap as when a mechanical bond between the fins and central member is used, and, by avoiding the presence of any cracks or joints to open up at elevated temperatures and collect dust, dirt and other insulating materials, assures the trouble-free operation of the fintubes during the entire life of the central tube.



Besides the Hairpin "Twin Section" design here illustrated there are five other standard designs: oil-tank suction heaters, fixed tube sheet heat exchangers, return bend heat exchangers, floating head heat exchangers, and gas coolers or heaters. The particular and outstanding feature of Brown Fintube heat exchange equipment is the use of Brown resistance-welded integrally-bonded fintubes as the transfer tube, which make them unexcelled for effecting heat transfers between liquids and gases, or other commodities having unequal transfer co-efficients.

Through the use of Brown integrally-bonded fintubes, having the desired number of depth of fins, the primary and secondary surfaces of Brown Fintube heat exchangers can be proportioned to the heat transfer co-efficients of the materials being heated or cooled, thereby compensating for any deficiency in the heat transfer rate of one or another of the commodities. This avoids the necessity of using hundreds, sometimes thousands of feet of bare tubing to satisfy the requirements of the commodity having the lower heat transfer co-efficient. It permits a fewer number, or shorter, Brown Fintubes to be used for a given heat transfer service than if plain bare tubes were used and results in smaller shells, less weight, less pressure drop, and many other important savings in manufacturing, shipping, installation and maintenance.

The Johnston and Jennings Co.

THE Oceco Division of this company offer two specialties. One of these is the newly approved Oceco gauge hatch. Good, gas-tight tanks, as everyone will readily appreciate, are expensive, and their contents are even more so. But the tanks are not tight, and their contents are not safe, unless the gauge hatch has been designed and built to maintain gas-tightness. As may be seen from the photograph the Oceco gauge hatch is easily opened by pressing straight downward on the foot pedal thus avoiding the danger and awkwardness of operating a vertical type pedal. The hatches are self-closing (i.e. they cannot be left open by a careless gauger) and are provided with a non-sparking composition ring, set in the cover, that seats tightly against the narrow seating edge of the body, thus assuring positive spark-proof, gas-tight closure which prevents any loss of volatiles through the hatch and the resulting fire hazard.

According to latest information received, the newly improved Oceco gauge hatches are so far the only gauge hatches that have been tested and approved by the Underwriters Laboratories.

Another specialty on which the Johnston & Jennings Company lays emphasis is the Oceco 6-inch type "B" vent unit, also shown in a photograph. This equipment consists of an Oceco flame arrester, Oceco vent valve and flame snuffer, designed to assure a maximum of conservation and safety to the tank and its contents.

The housing of the flame-arrester is a strong, semi-steel cast housing, having high melting point, and capable, therefore, of withstanding severe exposure to fire without warping or destruction, thus assuring the proper operation of the unit at full efficiency, an advantage not afforded when housings of lower point melting material is used.

The corrosion-resistant "bank" or "element" assembled from flat and corrugated sheets of aluminum arranged alternately to form vertical straight through passages is an absolute flame stop, yet assures free tank breathing with minimum pressure drop. The entire absence of screens and tortuous channels minimizes entrainment of condensation and clogging. Access to the bank is obtained easily by loosening a single hand wheel, and lowering the hinged gas-tight inspection door. There is nothing to fall off to the ground and no tools or wrenches are needed.

Oceco gauge hatch.

How to Tighten Sucker Rods

THE S. M. Jones Company of Tulsa call attention to one kind of trouble in a pumping well that may be overcome. This trouble is sucker rod pin failure, which is the direct result of the opening of the face contact between pin shoulder and coupling under load, thus allowing the joint to loosen and putting unnecessary stress on the pin.

Much has been written about the importance of using proper snap wrenches for the proper make-up of sucker rods. But in actual practice it is difficult to know that each joint has been tightened to just the right amount. Some roustabouts are stronger than others, and the same roustabout may be more energetic at one time and another, with the result that the rods may be under or overstrained, all because of a lack of means for measuring the torque applied.

In order to help in the solution of this problem, The S. M. Jones Company has done some experimental work measuring applied torques in the laboratory and then putting the joint in tension to determine at what loads the body of the rod would fail before the joint opened. The applied torque was then correlated with the movement of the coupling relative to the pin shoulder during the snapping or tightening operation. Improved finishing of the coupling face and pin shoulder of the rods helped to give consistent results in this work. Figure 1 illustrates the marking of a rod before being snapped up and Figure 2 the distance moved through the use of snap wrenches by the separation of the mark.

Fig. 1

Fig. 2

The distance of snapping for each size of rod covered in this experiment are as follows:

Rod Size	*Distance*
1″	¼″
⅞″	5/32″
¾″	3/32″

By following this marking procedure each joint may be made tight enough but not too tight.

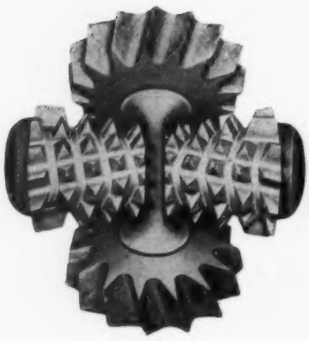


Fig. 1.

Fig. 2.

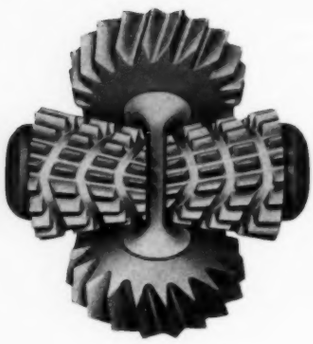


Fig. 3.

Fig. 4.

Globe Oil Tools

GLOBE Oil Tools Company of Los Nietos, California, for many years specializing on deep drilling products, now present the most complete line of rock bits in the company's history. We can here mention only four of the six types:

Type "STD-2" (Fig. 1): For unconsolidated formations, especially soft and sticky digging where circulation is an important factor.

Type "SD" (Fig. 2): For the general run of ordinary rock bit digging, such as medium hard shales, lime rock, chalk, and broken formations.

Type "RR" (Fig. 3): Engineered to dig through the hardest formations, which include dolomite, sand rock, chert, and hard lime rock.

Type "XX" (Fig. 4): The most recently developed type of Globe Rock Bit; used for the hardest formations.

Figure 5 is a cutaway view of a Globe Rock Bit, showing how the inner cutter pin is held firmly on both ends by body legs and braced by the center support. Globe Bits feature this reinforced construction, which holds the cutter pins in alignment under severe twisting strains, prevents the cutters from binding, reduces wear on bearings and pins, and prevents bit distortion.

Figure 6 shows how the gauge cutters rotate on pins which are supported by legs on the outside, and by the center support on the inside.

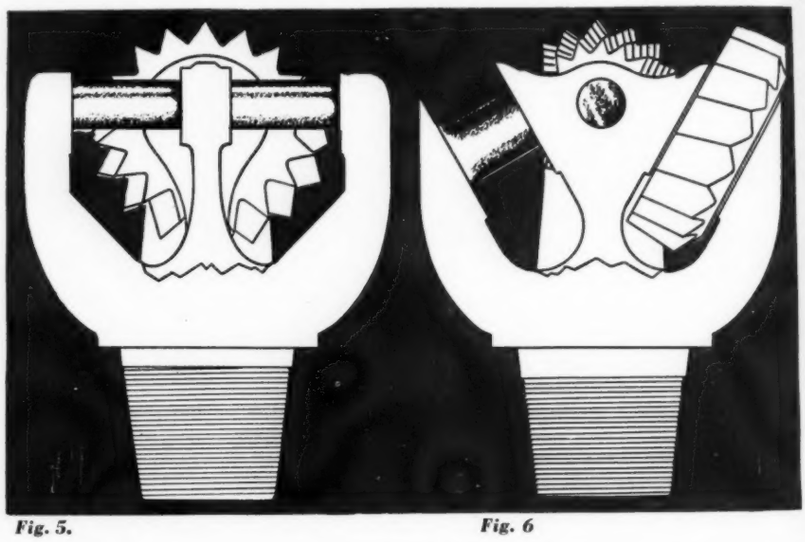


Fig. 5.

Fig. 6

Stoody Company

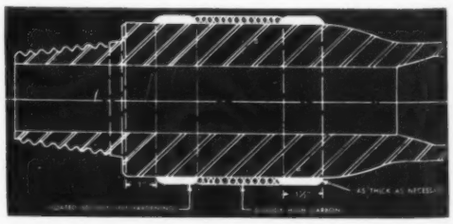
APPLICATIONS of Stoody hard facings include the hard-facing of all types of drill bits, wash pipes, hot oil pump sleeves, thrust washers, bailer points, mud pump valves, ditcher teeth, and various types of road making equipment. There are probably more than 10,000 Stoody hard-faced tool joints of all types in service at the present time.

Some of these joints were hard-faced when new, but the majority of hard-facing has been done in connection with worn or resleeved joints.

The obvious advantage of hard-facing worn joints is that the work can be done at the rig, eliminating the necessity of transporting the pipe from the field to the shop. In no case has the hard metal application failed to double tool joint life and in many instances, especially where Electric Tube Borium is used, the life of tool joints has been tripled.

The accompanying picture and diagram show how Stoody Self Hardening is applied to a worn integral joint drill pipe.

Other types of joints are rebuilt on the box ends only. Common practice is to weld all the joints to the pipe with mild steel first. A copper form is then butted up against the mild steel deposit and the joint is rebuilt to size with coated Stoody Self-Hardening. The manufacturer states that some operators seem to believe that the Self-Hardening should not be applied directly to the shoulder where it will come into contact with the elevators, but they themselves have not found one instance where joints rebuilt in this manner had any tendency to chip. Outstanding results have also been obtained by hard-facing resleeved joints, and new joints can be hard-faced in exactly the same manner as resleeved joints.



Method of hard-facing integral joint drill pipe, end only. Joints to be preheated to 300° F. before hard-facing.

Bands of Stoody Self-Hardening applied to worn pipe.

Baker Model "R" Retrievable Cementer

Baker Oil Tools, Inc.

THE Baker Model "R" retrievable cementer is used for cementing at one or more points in casing or liner without coming out of the hole between jobs.

The construction of the Cementer is shown in the accompanying illustration. The tool consists essentially of a cylindrical body and setting mandrel on which are mounted (from the bottom up) an 18" drillable tail pipe, an oil-resistant packing unit, slip units and drag spring assembly. The body is connected to the bottom of the setting mandrel by left-hand, square threads which serve as a safety joint to permit removal of all but the packing unit and body from the hole in the event of necessity.

The cementer is lowered into the well on a running-in string of drill pipe or tubing with a circulation joint directly above the cementer. When the job is finished the running-in string is lowered and this allows the packing unit and the slips to return to their fully retracted positions. The slips are then locked in position by rotation of the running-in string and the cementer is again free to move in the hole. During the placement of cement through the cementer the highest safe pressure that the casing or liner will stand can be applied to force the slurry where it is to go. The cement may be put away in batches if desired and during batch-cementing the cementer can be left in the packed-off position between batches providing the tool and perforations are purged with water.

Should the packing unit become frozen, it can almost always be released by lowering the running-in string and rotating ten turns to the right. This action partially unscrews the left-hand, square threads connecting the setting mandrel to the body of the cementer and in doing so jacks the lower assembly downward, thus allowing the slips to retract from the casing. A little strain on the running-in string will then usually release the packing unit. In extreme cases where it is impossible to release the lower portion of the tool, an additional fifteen turns (or more) will unscrew the left-hand, square threads entirely and allow the setting mandrel with all the assembly above and including the slips (as indicated by the blue in the illustration) to be removed from the hole.

◆

Eastman Bottom Hole Orientation

ONE of the most recent developments in the art of deflecting tool orientation is the method of orienting a tool after it has reached the bottom of the well. This method consists of recording the relation between a magnetic field placed in a known fixed relation with the tool face and the direction of the angle of inclination of the hole. The use of this method of bottom hole orientation makes possible greater speed and accuracy in the orientation of deflecting tools.

In the accompanying figure the Eastman Bottom Hole Orientation apparatus is shown in operating position while being used to orient a whipstock. A—drill pipe; B—barrel cut away to show the instrument; C—permanent magnets which form the known magnetic field; D—plumb-bob; E—magnetized disc which lines up with permanent magnet C; F—shear pin which maintains fixed relationship between whipstock face and sub until orientation is completed; G—stop plate for locating instrument; H—whipstock.

The deflecting tool is attached to the drill pipe by means of a shear bolt, which maintains the fixed relation between the face of the tool and the permanent magnets set into the special sub above the bit. The tool is run to bottom and the instrument is then lowered through the drill pipe on a wire line. The disc in the instrument is pulled into the azimuth of the permanent magnets and with the plumb-bob which hangs toward the low side of the hole, an indication is made on the disc, thus making a record of the relation of the position of the disc and the low side of the hole. After the instrument has been brought to the surface, the necessary orientation correction is quickly ascertained by means of a special reader and the deflecting tool is faced in the desired direction by carefully turning the drill pipe.

Method of deflecting tool bottom hole orientation developed by Eastman Oil Well Survey Company.

Lincoln Electric Co.

RECENT improvements made by engineers of The Lincoln Electric Company, Cleveland, Ohio, world's largest manufacturer of arc welding equipment, include the new "Lincontrol," a device which enables the welder to increase weld production and do a more accurate job. A unique feature of the "Lincontrol" is that it may be strapped onto the welder's foot (see illustration) and permits him to move about with it freely. With this unit, which weighs little more than a shoe, the operator has accurate control over the welding arc at all times without changing his position. By pressing down on the pedal of the unit, a pin controlling the electric current is depressed, thus increasing the current as desired. If more or less current is required during the welding process, as in instances where changes occur in thickness of the metal or fit-up, the control is adjustable so that the operator can change the current at the arc by merely moving his foot slightly.

The "Lincontrol" eliminates the need of making such adjustments on the welding machine, and is particularly applicable for welding thin-gauge tubing or sheet metal. Positive control reduces the danger of a weld burning through, increases the quality of the fusion and helps obtain proper penetration. The control is designed for use with the "Shield-Arc Junior" welder.

Left: "Lincontrol," an effective foot-operated unit, about as light as a shoe, developed by The Lincoln Electric Co. to increase welding accuracy and production on light-gauge metal.

Seismographic Service Corporation

THIS corporation has made available in South America a well logging service by drilling-mud analysis. In this service a continuous mud sample is circulated through the laboratory where the presence of gas is detected by a hot wire wheatstone bridge; dry gas can be distinguished from wet gas. Oil is detected by causing the oil globules to fluoresce in ultra-violet light. Rig greases can be distinguished from oil by their color. Salt water is detected by the apparent change in resistance when the mud passes through special electrodes. The arrangement includes facilities for recording the depth from which the mud cuttings are obtained, the weight on the bit at 2-ft. intervals, and "drillability," pump cycles per minute, pump cycles in hole, and gas are recorded on a strip of paper which constitutes a well log.

Without materially retarding progress Seiscor Well logging gives information regarding the fluid contents of porous formations, their depth below the surface, relative productivity, porosity, thickness, and drillability. This data provides:

Right: Interior view of Seisor Well logging laboratory.

1. The correct casing point or perforation pattern so that the well can be completed to produce the maximum volume of oil with a minimum gas-oil ratio.

2. An accurate and easily correlatable log for sub-surface geological work.

3. An accurate guide for either a "shot" program or acidization.

4. The location of the water table.

5. And information on condition of the bit.

Twin Disc Clutch Company

FOUR and one-half years ago, in December, 1938, to be exact, the first commercial hydraulic torque converter was shipped by the Twin Disc Clutch Company, Racine, Wis., to an oil field for application to a cable tool drilling rig. The torque converter's advantages were quickly recognized by the drilling industry; in a short time the desirability and superior performance of hydraulic drives was established.

The operation of a hydraulic torque converter is on generally the same principle as the operation of a steam turbine; in a steam turbine the driving force is supplied by the power of a current of high-pressure steam operating on the turbine blades; in a hydraulic torque converter the driving power is supplied by a circulating stream of water delivered by a pump against turbine blades. Figure 1 shows the general assembly of a hydraulic torque converter with pump and housing, and Figure 2 schematically represents the turbine. This diagram (Fig. 2) shows the combination of a hydraulic clutch and a hydraulic torque converter effected by the introduction of two sets of stationary blades between the three sets of turbine blades.

The outstanding characteristic of this combination and the one that fits the Twin Disc Clutch Company's hydraulic drives for many purposes of the petroleum industry is that it makes an internal combustion engine (even a Diesel engine) perform very much like a steam engine. A steam engine can exert its maximum torque when starting a heavy load, and can deliver smooth acceleration at maximum speed without any shifting of gears. On the other hand, the internal combustion engine requires speed to produce torque and horsepower and is liable to stall while starting heavy loads. The hydraulic torque converter and the hydraulic supplies just what the internal combustion engine needs: A transmission unit which provides an automatically variable torque-speed range, one that is not subject to stalling. Among uses in the petroleum industry may be mentioned:

Slush Pump Drives: In the case of an internal combustion engine equipped with a hydraulic clutch, if a bit becomes plugged, the clutch will absorb shock until such time as the engine can be stopped and the obstruction removed, thus protecting the pump against damage. (See Figure 3.)

Compressor Drives: Directly connected to the engine and compressor, the hydraulic clutch provides definite advantages where automatic starting and stopping of the engine is used. The low drag torque at the cranking speed of the engine permits the engine to be easily and quickly started at reduced load, followed by smooth and rapid acceleration of the load. Here, again, torsional vibrations and shock loads are easily absorbed.

Direct Connected Rotary Table: Here, the drive is taken from the engine through the converter, directly to the rotary table. In this way, the varying loads at the drill pipe are met immediately by the converter's automatic torque-speed adjustment.

Multiple Engine Drawworks: For multiple engine applications where two or more engines are compounded, the torque converter is installed as part of the drawworks instead of being direct-connected to the engine. This allows the engines and the mud pump to be run at constant speed, but provides a variable speed for the hoist or the rotary table.

Cable Tool Rigs: The first advantage of the torque converter on a cable tool rig is its ability to dampen out the torque reversals which are caused by the reciprocal motion of the beam as it lifts and drops the tools. The second is the ease with which the torque converter automatically adjusts the line speed.

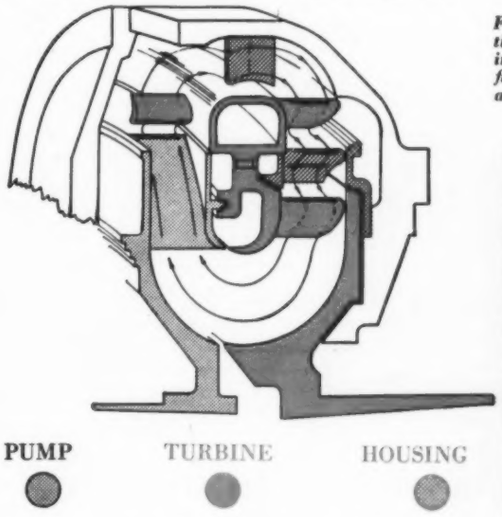


Fig. 1: General assembly of a hydraulic torque converter with pump and housing.

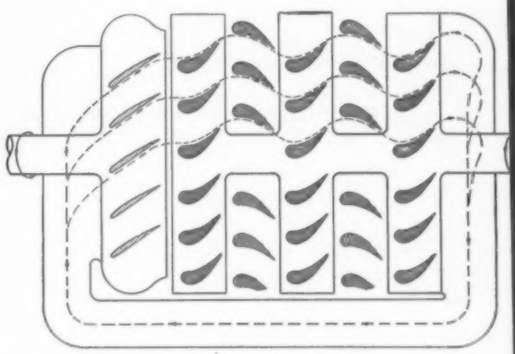


Fig. 2 above: Schematic diagram of fluid circulation in the Hydraulic Torque Converter. Torque increase obtained in converter is generated as the fluid passes alternately through, and reacts against, the stages of the turbine and stationary blades of the housing.

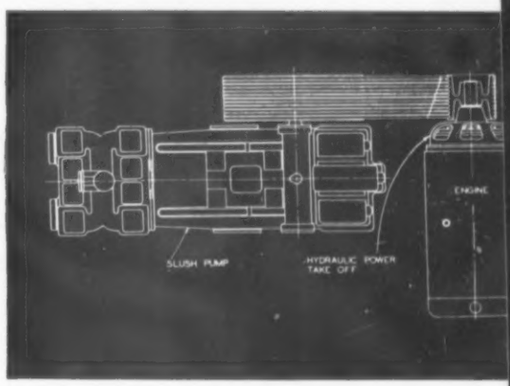


Fig. 3: Typical slush pump drive through Hydraulic Power Take-off.

E. I. DuPont De Nemours and Company

A NEW and faster device for joining dynamite cartridges used in seismic prospecting for oil, called the du Pont "Fast-Coupler," has been developed by the Explosives Department of E. I. du Pont de Nemours & Company. The coupler is a convolute-wound paper tube provided with gripping rings. For joining five pound dynamite cartridges it is approximately fourteen inches long.

Inside and near one end of this tube a ring with a sharp corrugated edge is installed and fixed in position in a recess in the tube wall. A similar ring, which is free to slide about four inches in the line of the axis of the tube, is installed in the other end. These rings are so designed that they offer little resistance to the passage of a dynamite cartridge when pushed into the coupler. However withdrawal of the cartridge from the coupler is prevented by the gripping action of the corrugated edge of the ring. An illustrated bulletin, with directions can be obtained by writing to the manufacturer.

Right: A member of an oil prospecting crew uses the new du Pont "Fast Coupler" to join dynamite cartridges for a charge with which to make a seismic shot.

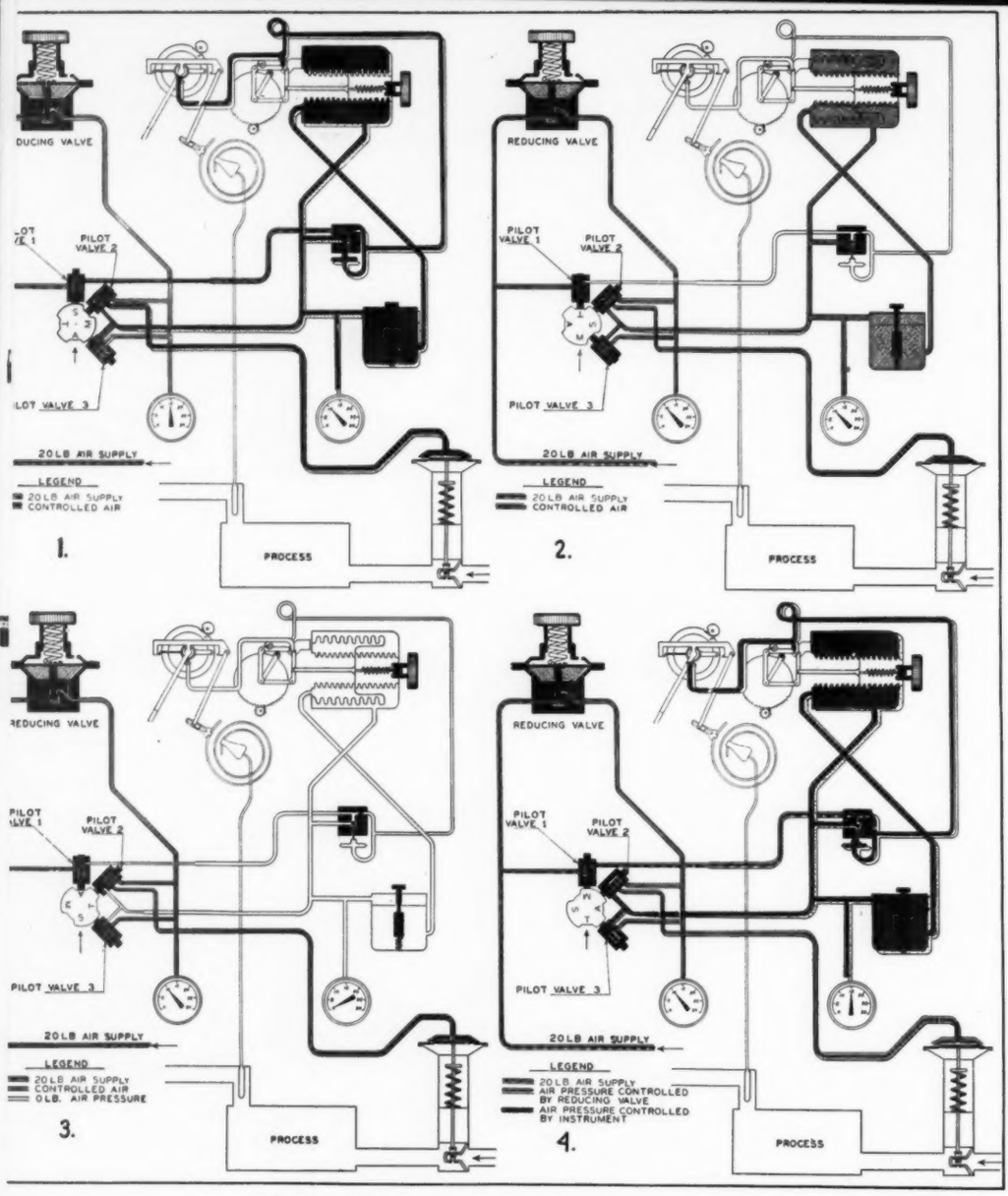


Figure 1. Schematic diagram of Taylor automatic-manual unit in Taylor Fullscope recording controller equipped with adjustable sensitivity and automatic reset. A—Automatic position. M—Manual position. S—Service position. T—Test position.

Taylor Instrument Companies

FOR better control of the operation of fractionating columns, polymerizers or heat exchangers, this company has introduced a new feature into the case of its Fulscope Controller. This new feature permits of instant transfer of process control between automatic and manual operation, and is designed as a convenient means of minimizing disturbances in starting up the process, and for effecting repairs to instruments that have become damaged. Four control positions are available; "automatic", "manual", "service", together with a new step, "test". Operation details are illustrated by means of schematic drawings in Fig. 1.

"Automatic" position. Control is automatic. Air supply reaches instrument mechanism through pilot valve No. 1 of the selector assembly. Reducing valve output pressure is sealed off in pilot valves 2 and 3.

"Manual" position. Before turning selector valve adjusting knob to "manual", the air reducing valve is regulated for an output conforming to the pressure on the motor of the controlled diaphragm valve. This pressure is indicated on the gauge in the lower right corner of the instrument case. In the "manual" position, the output pressure of the air reducing valve passes through pilot valve No. 2 to the diaphragm valve motor. This same pressure passes through pilot valve 3 to seal off in the mechanism of the controller. The idle instrument mechanism is thus charged with the exact operating pressure of the process controlling valve. This condition of balance permits of the instant and practically disturbance-free return of the process to automatic control.

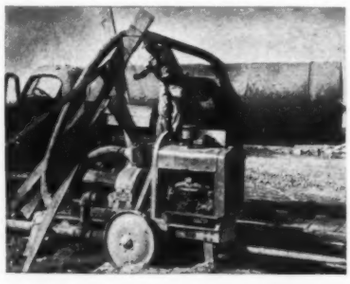
"Service" position. Control is still manual but the instrument mechanism is cut off from the air supply. In this position the controller can be serviced as desired without effect on the diaphragm valve.

"Test" position. In this new position, control is manual. However pilot valve No. 1 is now open and the full, 20 psi. supply pressure applied to the instrument mechanism, exactly as if the instrument were controlling. This pressure seals off in pilot valves 2 and 3. The test position was designed to allow precision instrument adjustments to be made with the aid of operating air pressures but without disturbing the position of the manually controlled valve. On completion, control is returned directly to "automatic" or back through the "manual" position.

Taylor automatic-manual unit is available in single duty Fulscope record controllers equipped with adjustable sensitivity and with either automatic reset or pre-act. The device can also be added to such an instrument in the field. No drilling or tapping of case is required and necessary tubing is supplied, preformed for ready assembly.

Chain Belt Co.

CHAIN Belt Company of Milwaukee is manufacturing a line of self-priming centrifugal pumps for the oil field ranging in capacity from 3000 gallons per hour to 125,000 gallons per hour. Among the uses these pumps find in the oilfields are: Supplying water to drilling; handling drilling mud from rig to rig and from storage to rig; transferring oil from storage to tank



Rex pump transferring oil direct from a pipe to a tank truck.

cars; lifting oil from gathering lines to separators; removing waste oil from under rig floors; dewatering fire wall trenches, etc.

Outstanding features of these pumps include patented air peeler which peels the air from the impeller when the pump is priming. Even when the suction line is leaking air a Rex Speed Prime Pump will keep right on delivering, or when pumping mud or heavy oil a Rex will still go strong. Other features are a "Z" Metal Impeller which has greater resistance to abrasion and corrosion. Automatic governors on all Rex pump engines are equipped with a variable speed control which enables the operator to regulate the speed of the pump to meet varying conditions. All Rex oil field pumps are portable and can be easily handled from rig to rig. For further detailed information, the company has available catalog No. 400 which it will mail on request.

Shand and Jurs

USING the test facilities and assistance of the Chicago Bridge and Iron Company, Shand and Jurs Company have pioneered in the development of a new high pressure regulator for spheres, cylinders, blimps, bullets, and other types of rigid pressure storage vessels. Needless to say, these units are in great demand by the synthetic rubber industry.

This regulator meets the specific and exacting requirements for the close and safe control of the pressure within such vessels; means are provided so that if any part of the regulator should fail it cannot help but fail *safe*.

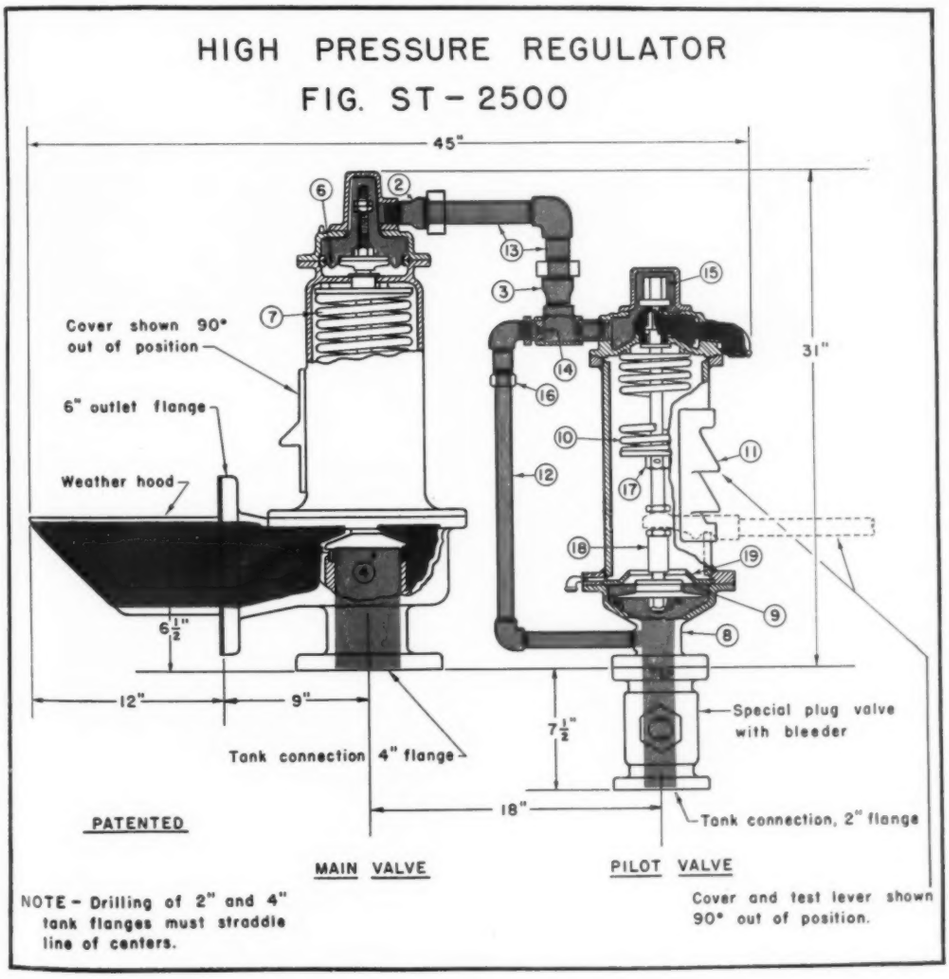
Shand and Jurs Figure ST-2500 Regulator has been developed to eliminate the troubles which have been found inherent in the conventional spring loaded type of vent, and also the counterweight and lever operated still type breather valve. The ST-2500 has been designed to be positive in operation and to provide the close regulation which results in a material decrease of vapor loss over that which occurs during the venting period when other types of vents or relief valves are used.

In the design of the ST-2500 High Pressure Regulator has been included reserve force for breaking ice, gums, tars or other adhesives on the seating and bearing surfaces. Bearing areas have been held to an absolute minimum, and no lubrication is required in any of the various parts of the regulator. An exact pressure setting is maintained by the regulator with a minimum of blowdown. There is no pressure accumulation above working pressure, for full opening results in close regulation which decreases the vapor loss during the venting period. With greater than 75 percent of the operating pressure on the tank, the main valve may be tested by operating pressure on the tank, the main valve may be tested by merely shutting off the pilot; otherwise either pilot or main valve may be checked with the test lever.

The operation of the regulator is briefly described as follows: (for numbers referred to, see drawing.)

Tank pressure is exerted on main valve pallet (4) tending to lift pallet from seat ring (5). At the same time, tank pressure is fed thru piping (12) and (13) to main valve diaphragm (6). Force exerted on main valve diaphragm (6) together with downward force exerted by main valve spring (7) holds pallet (4) closed against tank pressure. As the venting pressure is approached tank pressure working upward on pilot diaphragm (9) overcomes downward force of pilot spring (10) and opens poppet (15) venting tank pressure in pipe (13) and over main valve diaphragm (6) to atmosphere. Volume of vapor fed thru pipe (12) is limited by orifice (14). This causes an ejector effect further reducing pressure over main valve diaphragm (6). As pressure is relieved from diaphragm (6), upward force of tank pressure on pallet (4) overcomes force of spring (7) and main valve opens. As tank pressure is reduced thru the main valve pilot spring (10) overcomes the upward force of diaphragm (9) and poppet (15) closes. Pressure is again trapped over main valve diaphragm (6) and pallet (4) closes.

The red area in this diagramatic sketch indicates utilization of tank working pressure on the diaphragms (6) and (9), the poppet (15) and the main valve pallet (4). The blue area indicates the actual relief of tank pressure above diaphragm (6) out through poppet (15) and the full venting of excess tank pressure through the main valve at (4) and (5).



Ralph N. Brodie Co., Inc.

Brodie Model X meters equipped with type G horizontal counter.

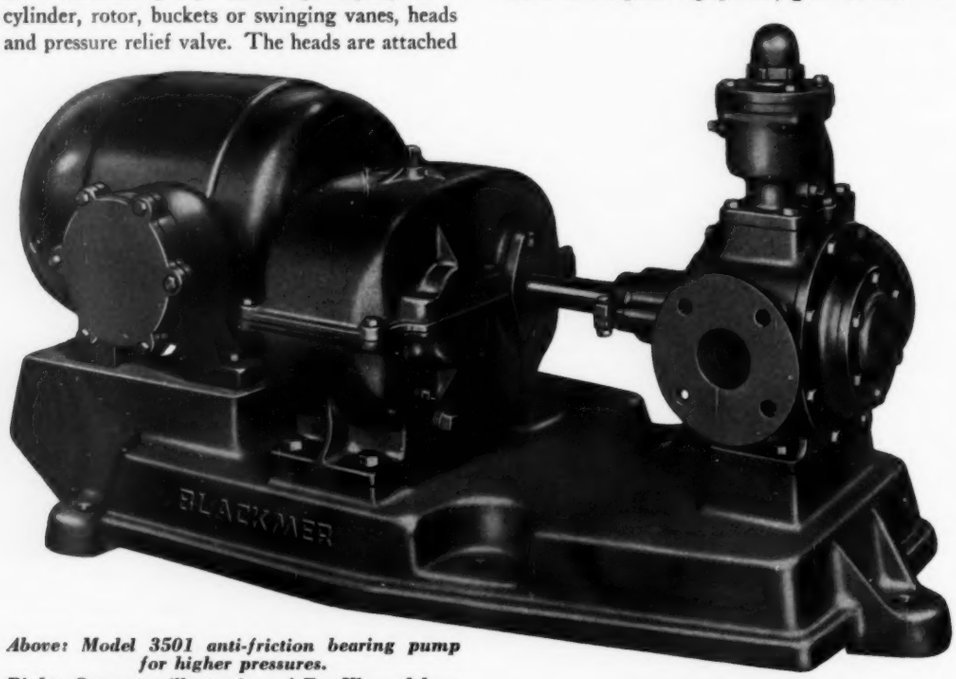
BRODIE meters are of the positive displacement type and embody the important principle of positive displacement measurement. They are designed to provide an exact and continuous volumetric measurement of petroleum liquids such as oil, distillate, kerosene, naphtha, gasoline and other liquids of similar nature wherever these liquids flow through a pipe line by gravity or under pump pressure.

These meters are furnished in various sizes from 1¼" to 6" with capacities ranging from 2 to 1000 gallons per minute. All Brodie Model X meters embody the same general design and principle. They are furnished with various types of counters—horizontal, Brodimatic, vertical, Quantrol, barreling, and printing counter, etc.

In line with the current theme "Regular inspection is your best protection" this company has recently issued a maintenance bulletin on the care and adjustment of Brodie meters.

New Blackmer Pump With Anti-Friction Bearings

AMONG the more important recent developments by the Blackmer pump engineering staff is a new unit with anti-friction bearings. This new Blackmer pump consists principally of a cylinder, rotor, buckets or swinging vanes, heads and pressure relief valve. The heads are attached



Above: Model 3501 anti-friction bearing pump for higher pressures.
Right: Cut-a-way illustration of Ezy-Kleen deluxe strainer.

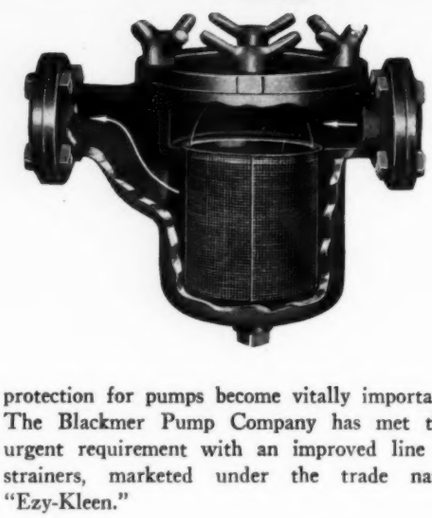
to the cylinder by capscrews and are accurately located. Anti-friction bearings are fitted into each head and support the rotar and shaft so that a clearance of approximately .002 to .005 inches exists between the rotar and the upper section of the cylinder bore. The buckets or swinging vanes are kept in sliding contact with the bore of the cylinder by centrifugal force. Their passage through the space between the rotor and the 92 degree lower arc draws the liquid through the intake port and at the same time forces it out the discharge port.

The suction and discharge ports are horizontal and placed directly opposite each other, providing a streamlined flow through the pump and minimizing turbulence. The unit is furnished with or without a relief valve. The anti-friction bearings are located on either side of the pump casing. The stuffing box is on the drive side of the casing readily accessible for repacking. Due to the fact that the bearings operate in the pumpage, this unit is recommended only for liquids having lubricating properties such as oils, molasses, syrups, etc.

Standard sizes are available in capacities from 10 to 750 GPM at pressures up to 150 psi, and temperatures up to 350° F. Units with steam-jacketed heads are furnished for handling liquids of high viscosity or materials that are solid at room temperature. Removable liners which may be easily replaced when worn are available for all sizes of pumps. Units are also available with both steam-jacketed heads and removable liner.

Blackmer Ezy-Kleen Strainers

WITH the present-day emphasis on conservation of all plant equipment, good strainers as



protection for pumps become vitally important. The Blackmer Pump Company has met this urgent requirement with an improved line of strainers, marketed under the trade name "Ezy-Kleen."

The two important features of Blackmer strainers are their slight resistance to the flow of liquids, and the ease with which they may be cleaned and restored to service. The first fact is accomplished by means of oversize straining area, which is up to ten times the pipe area, and in all cases several times greater than the standard of the Hydraulic Institute. The convenient wing nuts on the deluxe line and the accessible slotted lugs and flanges on the "low swing" and "T" type units makes the cleaning operation extremely simple. Standard baskets for deluxe line of strainers are made of heavy mesh of perforated brass, with handle for dumping; fine mesh for gasoline, water, alcohol, etc.; medium for lube oils and similar liquids, and coarse mesh for molasses, glue and other viscous liquids.

Grip-Tite Manufacturing Company

THIS company manufactures a new grip-tight anchor for oil field derricks which is offered to the industry as the "only positive expanding anchor constructed especially for heavy oil field use." A reference to the illustration will show that this anchor is constructed with the spreader dovetailed into the wings in such a manner that the anchor wings are locked to the spreader block at all times. This action is positive; if at the time of installation the anchor wings have not been expanded, the anchor will nevertheless expand and lock when load is applied. It comes in three models, all made of certified malleable iron.

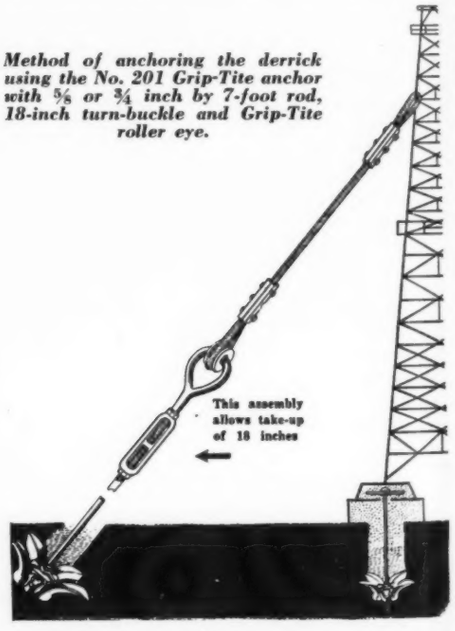
The No. 201 anchor installs in a 6 in. hole and spreads to 16 in. in diameter; is made with 4 wings and can be equipped with either a 5/8 in. or 3/4 in. rod.

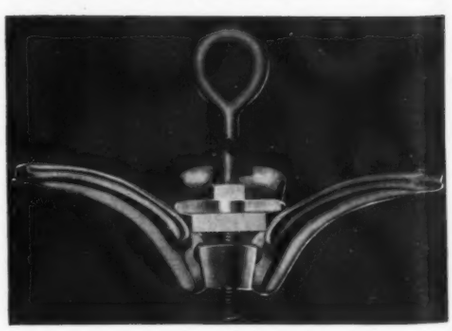
The No. 301 anchor installs in a 9 in. hole and spreads to 21 in. in diameter; is made with 3 wings and can be equipped with 3/4, 1, and 1 1/4 in. rod.

The No. 101 anchor installs in a 10 in. hole and spreads to 26 in. in diameter; is made with three wings and can be equipped with only a 1 1/4 in. rod.

No dirt disturbed either above or below anchor.

Method of anchoring the derrick using the No. 201 Grip-Tite anchor with 5/8 or 3/4 inch by 7-foot rod, 18-inch turn-buckle and Grip-Tite roller eye.





Sperry-Sun Well Surveying Co.

IMPROVEMENTS have been made on the K-K whipstock and retrieving sub combination, which represents a removable type of whipstock by the use of which "roll-off" of the bit, as well as wedging of the bit between the whipstock and the wall of the hole is eliminated, and the whipstock can be withdrawn at the will of the operator.

The latest type of retrieving sub is shown in Figures 1 and 1A, in two cross sections. Figure 1 shows the cross section through the mud channels. These are arranged diametrically opposite and off the center of this sub. By by-passing the mud fluid, errosion of the operating parts and the latches is completely eliminated. Figure 1A shows the arrangement of the latches and their operating parts. The left-hand latch is shown locked while the right-hand latch is shown released, and extended outwards. The whole locking assembly forms one unit which can be easily removed from the sub by withdrawing it after unscrewing the two horizontal screws.

Figures 2, 2A and 2B show the whipstock and retrieving sub combination in three different stages of operation. Figure 2 shows the assembly in two views as it is made on the drilling rig. The retrieving sub has been inserted in the whipstock collar and the latches extend outward, fitting into the matching grooves provided in the upper section of the whipstock collar. The whipstock is also attached to the retrieving sub by a shear pin of about one inch in diameter. Inasmuch as the latches fit into the grooves of the whipstock, the whipstock can be rotated into the hole without endangering the prematurely breaking of the sheet pin in the event a tight place is encountered during the lowering at any point in the hole.

Figure 2A shows the position of the bit and retrieving sub after the whipstock has been properly oriented and weight has been applied to break the sheer pin.

After about fifteen to twenty feet of rat hole has been drilled, the drill pipe is raised to the same depth position it occupied after the breaking of the shear pin. A "go-devil" is dropped inside of the drill pipe. When the "go-devil" hits the plunger of the operating assembly in the retrieving sub, the latches are unlocked by the force of the horizontal double helical springs pressing against them and are extended outward. The extended latches catch in the slot depression arranged on the lower section of the whipstock collar and the whipstock can be removed from the hole by withdrawing the drill pipe.

Figure 2B shows the position of the retrieving sub with the expanded latches at the time the driller is ready to pull the whipstock out of the hole. In case of a cave-in the drill pipe can readily be withdrawn from the hole in its entirety.

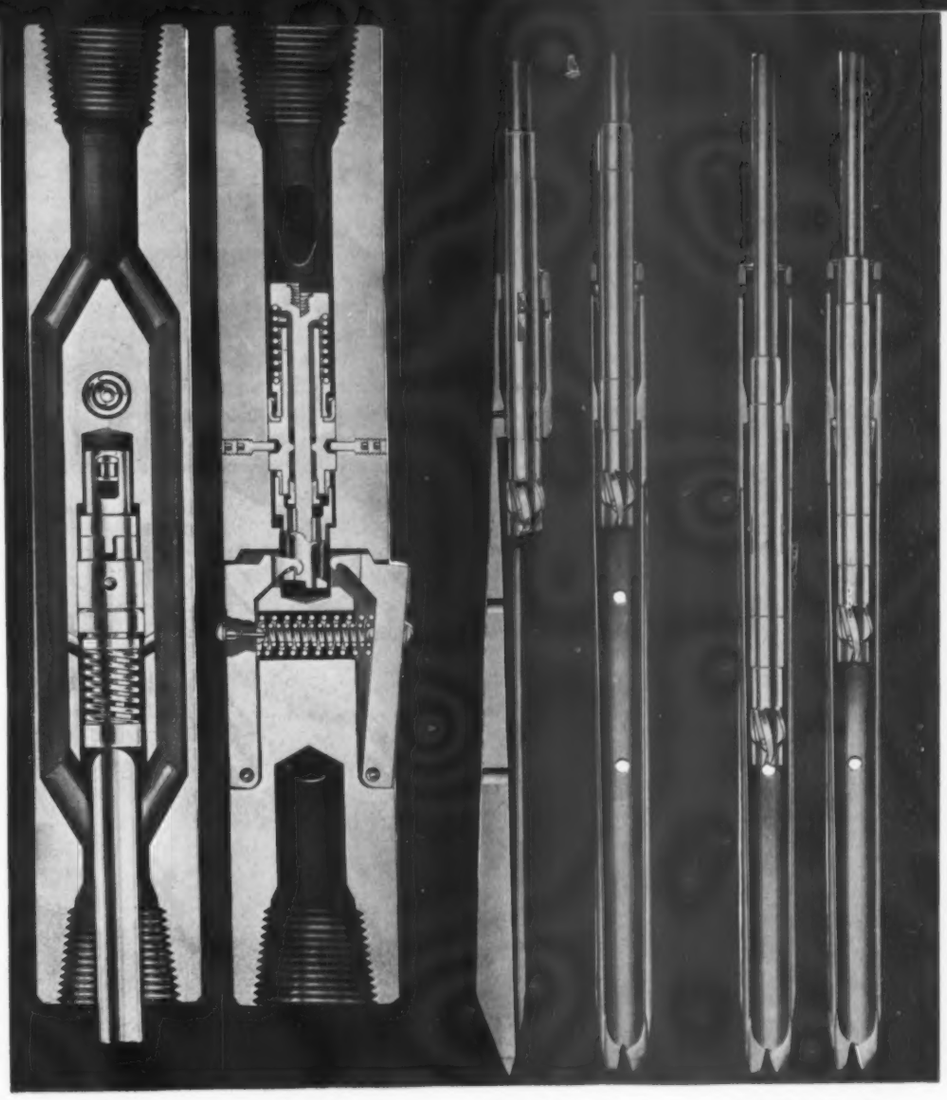


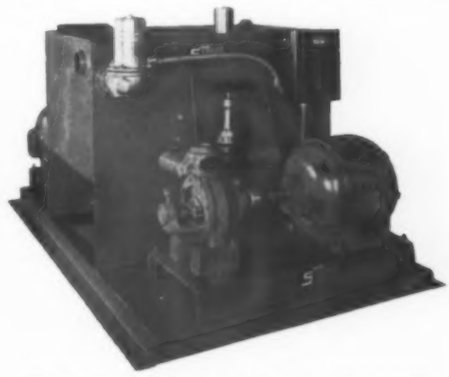
Fig. 1 *Fig. 1A* *Fig. 2* *Fig. 2A* *Fig. 2B*

Fred H. Schaub Engineering Co., Inc.

THIS company has put out a new line of Schaub "Series G" condensate return units in various models for the recovery and handling of boiler feed water. These units are completely prefabricated, with all inter-connecting piping and wiring installed ready to "plug in." Designed to conform to War Department, Chief of Engineers Specifications No. 8672-E Rev., these quality-built, compact, low cost units will meet a variety of requirements for industrial as well as military applications.

In the boiler room this unit is used as an auxiliary unit that serves not only as the ultimate receiver for all high and low pressure returns, but also maintains uniform boiler water level automatically, adds necessary make-up water automatically, and provides high and low water fuel cut-off protection and high and low water alarm.

Where high pressure process or heating returns are brought back to the boiler directly, the Schaub heat reclaim system can be used to advantage to recover "flash" heat in the returns. This system reclaims all the heat in the condensation above 212 deg. which would otherwise be lost out the receiver vent as "flash." Schaub trapless heat reclaim system provides all the benefits of the heat reclaim system plus better heating results on process equipment. This is brought about by the substitution of draintrols for conventional individual traps on each piece of process equipment or heating element using high pressure steam. Draintrols are a unique Schaub drainage device that provide for continuous discharge of all air and condensation.



Duplex type Schaub condensate return unit.

UNIT RIG & EQUIPMENT COMPANY

UNIT Rig's newest drilling unit is compact and powerful and has several unique features. It will drill to 7,500 feet with 3½ inch drill pipe or 6,000 feet with 4½ inch drill pipe and occupies little space when on location. If necessary, it can be broken down into several mobile sections, consisting of the draw works proper; the power units composing a section of the compound and three engines; and the mud pump section. Usually the draw works, compound and power units are moved intact, all in one load.

The U-10 draw works has six speeds on the drum, rotary table and cat shaft. This unit can be quickly converted to four speeds forward and two speeds reverse for all operations. The drum has a large barrel with ample space for cable and the brake flanges are of alloy steel 44 x 10 inches designed for efficient water cooling. The transmission is of the chain-drive oil bath type, completely enclosed, yet all assemblies are easily accessible.

One of the features which makes for speed and safety is the arrangement of the spinning line cathead. It is located on the catshaft to one side of the center of the well so that the forked spinning line will be in proper position for drill pipe spinning and tonging. See plan view. This is much safer than where the cathead is installed in the conventional way and the driller has unobstructed view of the operations.

One of the outstanding features of this draw works is the flexible speed control system which permits instantaneous shifting of speeds through Unit Rig's one level flexible speed control. Unit Rig's own Air-O-Matic Clutches are used for the drum drive and rotary table drive. These clutches engage smoothly, with no destructive shocks being evident in any of the operations, which results in longer life to drill pipe and drilling equipment. The facility and smoothness of control is very evident in elevating masts over this equipment.

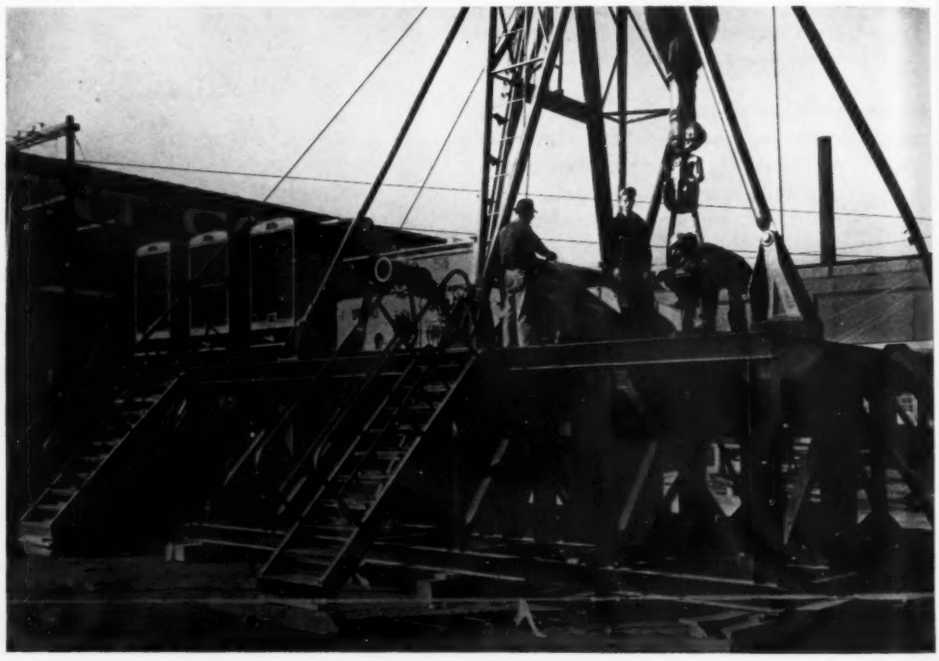
The power unit consists of a completely enclosed compound drive system with two or three engines coupled to the compound drive shafts through Air-flex air clutches. These require no adjustment, are short-coupled, insuring the minimum overall width of the power unit; and they facilitate quick removal and re-assembly of the engines to the compound system. The clutches are controlled from the driller's position. The compound has a splash-type oiling system which is in common with the draw works oiling system and is served by a very simple oil filtering system.

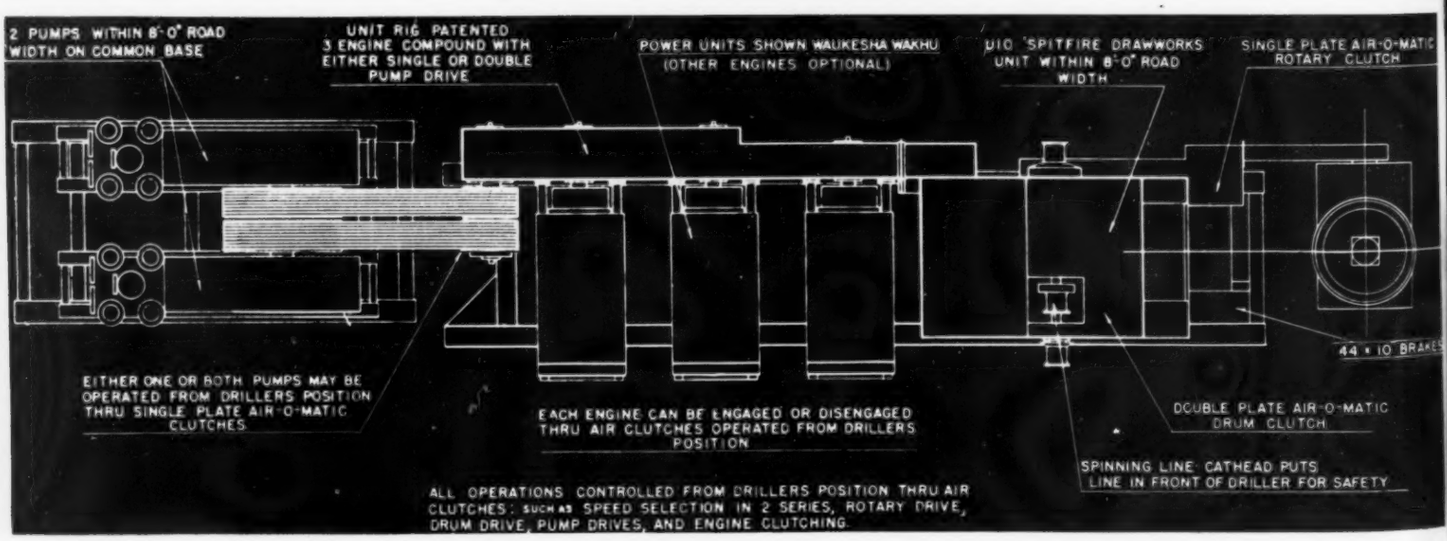
Two 7¼ x 12 mud pumps are mounted on one common skid and are arranged to drive through V-belts from Air-O-Matic Clutched pump drive pulleys. The pumps are also instantly controlled from the driller's position. The valve control is simple, since one lever will throw either one or both of the pumps into use. The drilling unit, while primarily designed for mast operation (since it is easily moved and rigged up), works equally as well under derricks.

Worthington Angle Gas Engine Compressor

THE new Worthington LFC angle gas engine compressor unit embodies outstanding and noteworthy improvements over its predecessor, the LCE. These units are of the right angle type with vertical in line four cycle gas engine power cylinders and horizontal compressor cylinders. Three sizes, 150 HP, 225 HP and 300 HP, are available, all operating at 350 R.P.M. Outstanding improvements and features of this new line include:

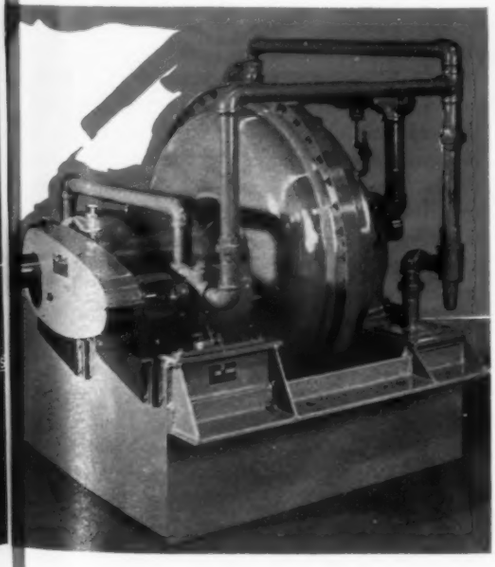
The Unit Rig drilling unit, below, is easily moved and rigged up.




2 PUMPS WITHIN 8'-0" ROAD WIDTH ON COMMON BASE
UNIT RIG PATENTED 3 ENGINE COMPOUND WITH EITHER SINGLE OR DOUBLE PUMP DRIVE
POWER UNITS SHOWN WAUKESHA WAKHU (OTHER ENGINES OPTIONAL)
U10 SPITFIRE DRAWWORKS UNIT WITHIN 8'-0" ROAD WIDTH
SINGLE PLATE AIR-O-MATIC ROTARY CLUTCH
44 x 10 BRAKES
EITHER ONE OR BOTH PUMPS MAY BE OPERATED FROM DRILLERS POSITION THRU SINGLE PLATE AIR-O-MATIC CLUTCHES
EACH ENGINE CAN BE ENGAGED OR DISENGAGED THRU AIR CLUTCHES OPERATED FROM DRILLERS POSITION
DOUBLE PLATE AIR-O-MATIC DRUM CLUTCH
SPINNING LINE CATHEAD PUTS LINE IN FRONT OF DRILLER FOR SAFETY
ALL OPERATIONS CONTROLLED FROM DRILLERS POSITION THRU AIR CLUTCHES: SUCH AS SPEED SELECTION IN 2 SERIES, ROTARY DRIVE, DRUM DRIVE, PUMP DRIVES, AND ENGINE CLUTCHING.

1. Twenty percent greater weight per horsepower, the major portion of which has been added in the entirely new main frame and the new power cylinder base in the form of heavy reinforcing ribs and heavier sections throughout.
2. Detachable compressor frames for easier transportation and installation.
3. Longer cylinder skirt and longer piston, giving greater bearing surface and less cylinder wear.
4. An additional oil control ring located at the lower end of the piston, resulting in much lower oil consumption.
5. Counterbalanced crank shaft for smoother operation, elimination of internal stresses, and reduction of external shaking forces. Many of these units are operating entirely satisfactorily on foundations set on piling in very poor soil.
6. Improved water jacketing for more uniform and effective distribution of cooling water and the elimination of hot spots and vapor pockets.
7. Attached gear driven recirculating cooling water pump.
8. External helical gear type lubricating oil pump, gear driven from the crank shaft, together with lube oil cooler and oil filter.
9. Gear driven cam shaft and governor with idler gear for adjustment of wear and quieter operation.
10. Low tension ignition (twin if desired) with all wiring in conduits or cable and dependable screwed wire connections at all points together with low fire hazard shut down controls for hazardous locations.
11. Improved type of compressor crosshead with double taper fit pin securely locked in place.
12. An improved simple, compact, rugged, reliable, speed and pressure governor for automatic control of either suction or discharge pressure when this feature required.

All of these improvement have been accomplished without sacrificing complete accessibility.



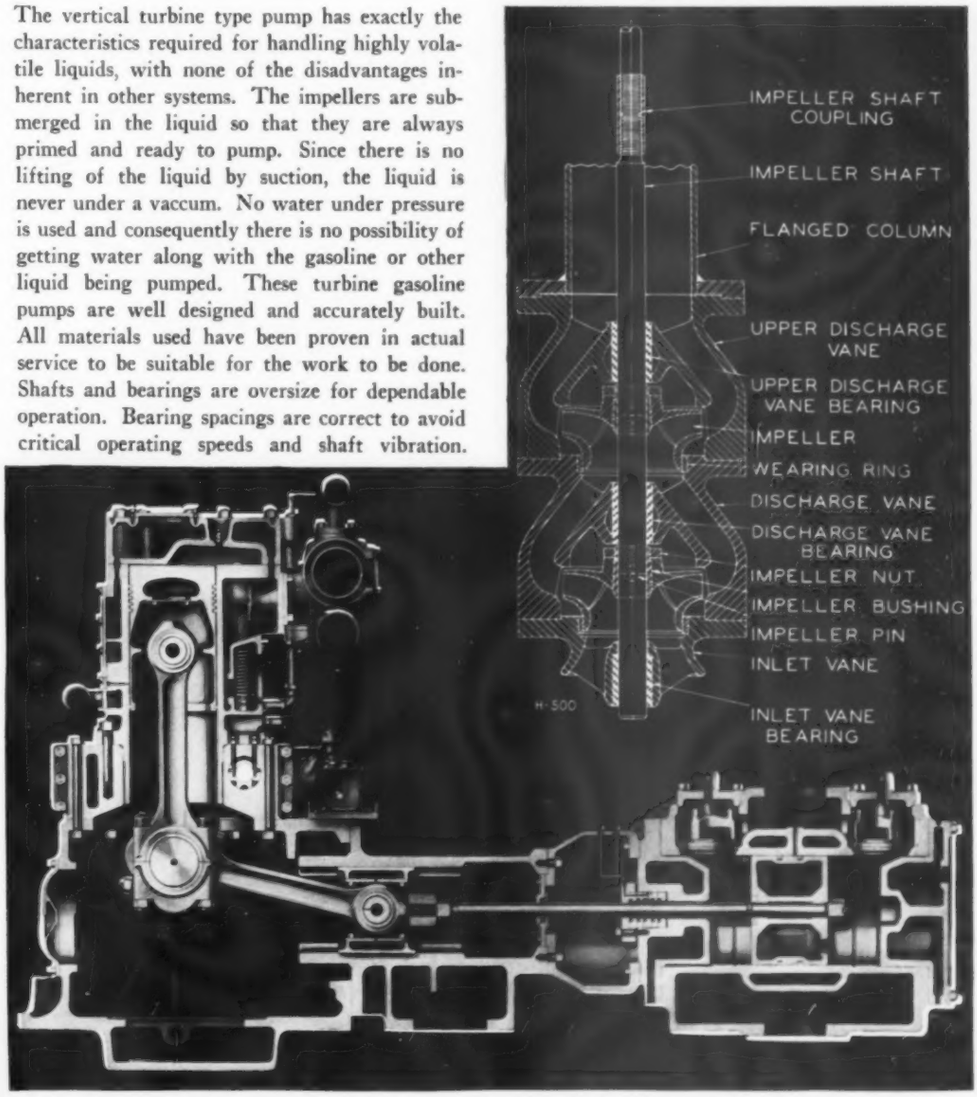
WORTHINGTON TURBINE GASOLINE PUMPS

For pumping high-octane gasoline, diesel fuel oil and similar liquids, Worthington Turbine Gasoline Pumps are ideally adapted to the exacting requirements of such service as storage depots, dispersed and non-dispersed airfield, and for numerous pumping requirements in the petroleum industry itself. They are especially designed to give many years of dependable service.

The vertical turbine type pump has exactly the characteristics required for handling highly volatile liquids, with none of the disadvantages inherent in other systems. The impellers are submerged in the liquid so that they are always primed and ready to pump. Since there is no lifting of the liquid by suction, the liquid is never under a vaccum. No water under pressure is used and consequently there is no possibility of getting water along with the gasoline or other liquid being pumped. These turbine gasoline pumps are well designed and accurately built. All materials used have been proven in actual service to be suitable for the work to be done. Shafts and bearings are oversize for dependable operation. Bearing spacings are correct to avoid critical operating speeds and shaft vibration.

Worthington has a complete line to meet all capacity and head requirements. Consequently, each installation is engineered to exactly fit the local conditions by utilizing the correct combination of standardized detail parts.

Worthington Turbine Gasoline Pumps are equipped with totally enclosed, fan cooled, Class I, Group D, explosion-proof motors.



Inner section of Worthington turbine gasoline pump.

HYDRAULIC COUPLING FOR DRILLING

The photograph to the left shows a 42" variable speed hydraulic coupling especially designed by the Hydraulic Coupling Division of the American Blower Corp. to fit into a drilling rig. This hydraulic coupling is inserted between the Diesel driving engine and the mud pump drive and performs the same function as the standard hydraulic coupling except that it is suitable for higher horsepowers and speeds. The tank has been narrowed to fit between the skid side members and the use of electrical current for driving the speed charge pump has been eliminated by the use of a chain driving pump operating from the outfit shaft. Speed and load control is obtained by manipulation of a simple set of valves.

In a hydraulic drive of this type there is no mechanical connection between the engine and the power take-off, the power being transmitted entirely through oil. The unit permits the mud pump to stall while the engine continues to turn over thus supplying full pump pressure without damage to the engine.

The particular unit shown in the photograph was designed for direct connection to a 350 hp.—600 r.p.m. engine.

Byron Jackson Co

Below: Drill casing bushing, and right, casing pump anchor.

Bushings for "Drill Casing"

THE increasing use of casing for the drilling string, in place of the usual drill pipe, is responsible for the development of these unique BJ Drill Casing Bushings which have proved completely successful for making-up or breaking-out "drill casing."

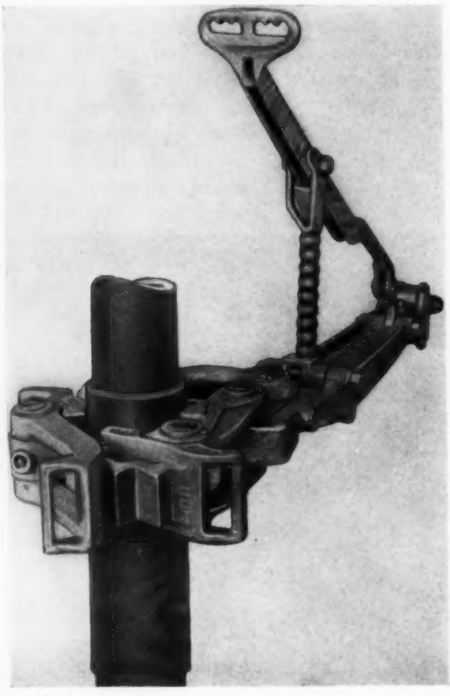
When casing is used for the drilling string a special type of tong is required, particularly to break out tight joints of the comparatively thin-walled casing. These drill casing bushings are furnished with a 12-inch bearing surface, and are bored to contact the entire circumference of the casing. In service these new Drill Casing Bushings break out the tightest joints without crimping or bottlenecking the casing, even after repeated round trips of the drill casing. Another successful use of these bushings is for setting any type of thin-walled casing, or for removing corroded casing which has been in the well for a long period of time.

New Casing Pump Anchor

THE increasing use of casing pumps is also responsible for a successful, new device for safely anchoring of such pumps and for prompt release when it is necessary to remove them from the well. The large-area slips have diagonal-cut teeth, and the hazard of damage to the casing is minimized.

Casing pumps usually are run in the well on the sucker rods, with the BJ Casing Pump Anchor coupled to the lower end of the pump. The Anchor Cage is equipped with friction shoes which contact the casing, and when the desired depth has been reached the rod string is raised until the key on the nipple comes out of the pocket in the Anchor Cage. Rotation to the right brings this key over its keyway and then by lowering the string the anchor holds the actuator and slips and the body expands the slips and sets them against the casing.

New BJ Tong Fits Wide Range of Sizes

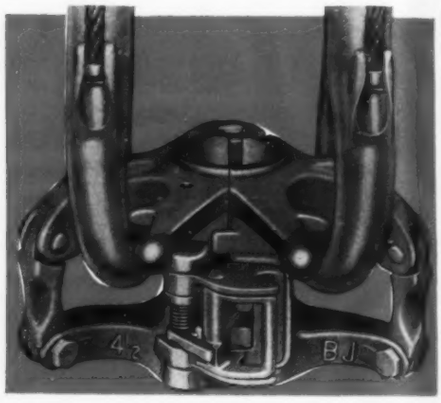


BY providing multiple steps for latching, and multiple jaws for flexibility, the recently designed BJ Type B and Type C Rotary and Casing Tongs handle a wide range of pipe sizes by merely installing the proper size latch lug jaw. Regardless of the pipe diameter, all jaws contact the pipe and exert uniformly equal pressure. Each Type B Tong can be equipped with any one of four different latch lug jaws which fit sizes from 3½ in. up to 10¾ in. Each Type C Tong will fit all pipe and tool joint diameters from 2⅜ in. to 8⅝ in. It is immediately apparent that the investment in tongs can thus be held to a minimum merely by having the required extra latch lug jaws on hand.

The modern design which enables these tongs to fit such a wide range of sizes, and at the same time maintain uniform contact around the pipe provides contacting radial cam surfaces on the end of the lever and the rear face of the short jaw, and the mounting of hinge pin for the short jaw in a sliding block in the lever. The short jaw is thus held in proper position to form, in conjunction with the other jaws, a true circle for all pipe sizes within the range of the tongs.

New 300-Ton Elevator

TO meet the increasing demand for an elevator to handle the longest, heaviest strings of 90 degree shoulder-type drill pipe, there is now available the BJ Type AA Elevator having a rated capacity of 300 tons, with a safety factor of four based upon the ultimate strength of the material. The entire body of this new elevator is heat treated to withstand the terrific pounding effect of tool joints contacted at high speed when



Byron Jackson Type AA elevator.

modern heavy duty equipment is used. All the basic features of the popular BJ Center Latch Elevators are present in this 300-ton model. A successful, new latch lock holds the Type AA Elevator latch closed and locked against accidental opening due to impact in the horizontal plane.

New Triplex Hooks Made in 3 Sizes

BJ TRIPLEX HOOKS are now made in three sizes: a 60-ton size for use with portable drilling rigs; a 125-ton size for wells of average depth; and a 200-ton size for use on all except extremely deep wells. Many important improvements in design and construction are apparent in these hooks. The standard Triplex (3-hook) body can readily be replaced with the DUPLEX (2-hook) body by removing only the shank pin. Ears on the upper housing permit direct connection to some traveling blocks; others require the adapter illustrated.

A unique double bearing consists of a small ball bearing which is never subjected to a load greater than that imposed by the enclosed relief spring. This smaller bearing permits effortless swivelling of the hook when spinning-in pipe. A larger bearing assumes any load beyond the capacity of the relief spring, and this bearing is of ample size and strength to carry the recommended

drilling load for each size hook. A swivel lock of new design provides eight positions for locking the hook to present rotation while drilling.

New Combination Tubing Hooks

A COMPLETELY new line of hooks, designed exclusively for the purpose of handling tubing, consists of BJ "75" - "50" - and "30" Tubing Hooks, each number designating the rated capacity of the hook, with a safety factor of four based upon the ultimate strength of the material. Both the 50-ton and 75-ton hooks are of the "Combination" design described below. The 30-ton hook is made with a SINGLE hook body only and is furnished with a swivel lock. It is not equipped with relief springs, a heavy duty ball bearing being sufficient to carry the loads imposed upon it. In both of the larger hooks, by removing only the shank pin, the body can be changed readily from the SINGLE hook type to the DUPLEX (2-hook) type. BJ weldless links are thus permitted to hang vertically so that the elevator is easily opened or closed, and a uniform load distribution is secured. The two larger hooks are equipped with an enclosed, low-stressed relief spring, having a 5-inch travel, which is strong enough to lift a stand of tubing clear of the collar, thus preventing damage to threads and speeding up operations.

For work-over or perforation cleaning jobs either side of the DUPLEX hook body can be used to pick up the swivel, and the full rated capacity of the hook is present when used for such purposes. This method is not recommended for continuous drilling operations due to the lost time in operating the locking arms. A straight pull is provided (as illustrated) and the swivel ball is

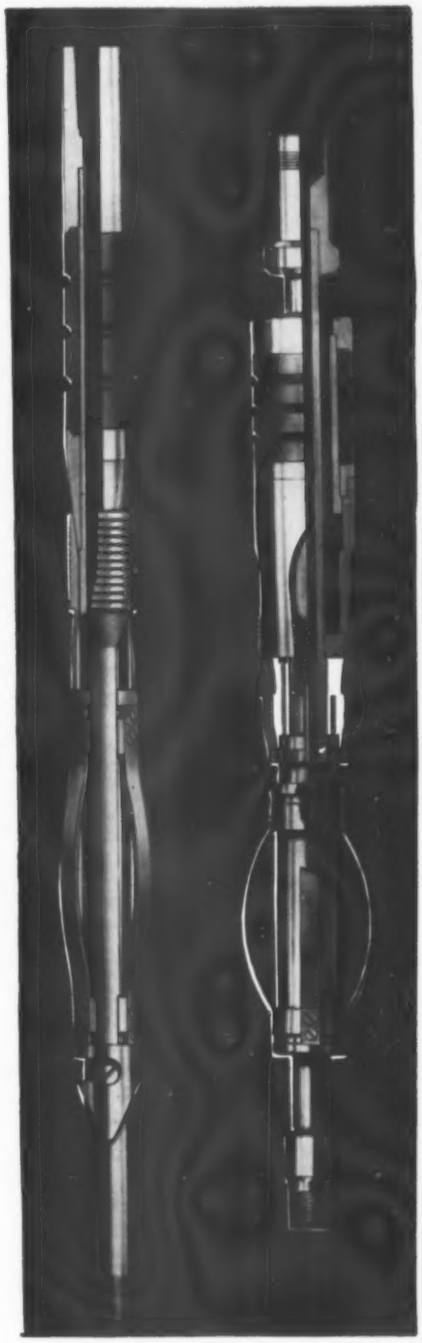
Combination tubing hook.

securely locked in safe against accidental "jumping" of the hook, with a heavy, overhanging metal section to take any upward thrust of the swivel bail. A swivel lock to prevent rotation, and an adapter for direct connection to the block are additional feaures when specified. All three sizes of these new hooks are shorter in over-all length than the corresponding sizes of previous types, an important feature where overhead clearance is limited in short derricks.

Tubing Flow Type Packer

THE Lane-Wells Olympic Thin-Wall Type CO Packer is designed especially for gas life or flow systems when a small, sturdy, and efficient thin-wall packer is required to pack off inside 2", 2½" or 3" tubing. On regular gas life applications it is used to reduce the orifice through which the oil is being produced, thereby reducing the volume of gas required and increasing production of the well. For producing heavy oil 2½" tubing is run on a standard Lane-Wells Hook-Wall Packer which is set above the producing zone. The Flow Packer is run on 1¼" tubing and set below the Hook-Wall Packer. Gas is injected through the smaller tubing to produce oil through the 2½" tubing. The reverse procedure can be used to produce light oil.

Standard equipment for the Olympic Thin-Wall Type CO gas lift or flow system packer is: Tubing threads for the top and bottom connection as ordered; four multi-set packing rings, fabric wrapped synthetic rubber core; three cross out slips; three friction springs; compact open type cage and hook assembly to facilitate external by-pass of fluid when running packer. Full details of operation and application are available from Lane-Wells Company, Los Angeles, California.



Above left, Lane-Wells Olympic thin wall type CO tubing flow packer, and right, Lane-Wells Olympic type BO circulation packer.

REED ROLLER BIT COMPANY

THE SHRINK-GRIP "SAFETY AREA"
ADDED PROTECTION AGAINST LEAKAGE
THE DISC (1) IS PULLED DIRECTLY AWAY FROM ITS SEAT BY THE OPENING LUG (2) BEFORE IT STARTS TO MOVE TO THE OPEN POSITION.
2
1
THIS EDGE REMAINS IN CONTACT WITH THE INNER BODY WALL, WIPING THE SURFACE WHEN VALVE IS BEING OPENED
2
1
R F

Reed gate valve with quarter-turn operation.

THE Reed Valve design is, basically, that of the double-disc gate valve but fully opens or closes with a quarter turn of the valve stem. A slight movement of the valve stem toward the open position pulls the trailing edge of the disc directly away from its seat. The valve is then moved to the full open position with exceptional ease.

The bodies and bonnets are constructed with heavy wall sections to insure low unit stress under operating conditions. A male and female bonnet joint is provided and close tolerances assure interchangeability. Bonnet flanges are extra heavy to prevent distortion in service. The stuffing box design prohibits fluid leakage past the valve stem and insures a minimum of frictional resistance between the packing and the stem. A two piece ball joint gland prevents binding and equalizes the pressure applied to the packing by the gland. Various types of packing are available and, as Reed Valve stems are non-rising and rotate through only 90 degrees, the packing is unusually long-lived. Disc holders are supported within the valve by integral trunnions at either end which operate in bearings provided within the bonnet and at the bottom of the body.

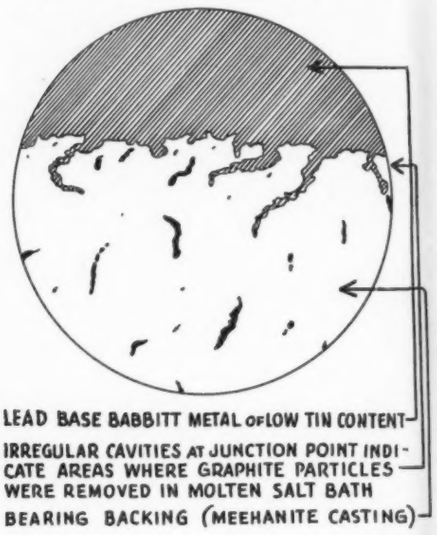
Reed Valves are cast or forged, in the smaller sizes, of the designated trim material, while the larger sizes are cast or forged and the trim material applied to the seating surfaces. All surfaces are adequately protected against corrosion.

Advantages of this valve include: 1. Positive position indication at all times. 2. Quarter-turn operation for instant service. 3. Non-rising stem; desirable where head-room is limited. 4. No stem threads; ideal for corrosive services. 5. Wear on packing minimized due to quarter-turn operation. 6. Exceptional large stuffing box. 7. Can be installed in any position. 8. Discs are not subject to expansion or contraction of the valve body and the valve will operate easily over wide temperature changes. 9. Through-conduit in the disc holder presents a stream-lined fluid flow passage and protects the body seats.

The Cooper-Bessemer Corp.

SAVINGS of more than 99 percent in the tin content of bearing babbitt, and the possibility of completely eliminating costly anchoring methods, have been disclosed in a recent announcement by this Corporation, which builds engines and compressors at Mount Vernon, Ohio, and Grove City, Pa.

Perhaps the most interesting of these two announcements is the second one, which involves the use of a recent method, known as the "Kolene" process, for cleaning bearing shells used in the C.-B. diesel and gas engines and compressors. In this process the bearing shells are dipped into a hot molten salt bath to remove carbon (graphite) from the surface of the iron. By cleaning out these particles in the metal a considerable amount of anchoring surface is added for bonding the babbitt, as may be appreciated by looking at the accompanying photograph. After a supplementary treatment to remove surface oxidation and dipping in a flux the backings are placed


LEAD BASE BABBITT METAL OF LOW TIN CONTENT
IRREGULAR CAVITIES AT JUNCTION POINT INDICATE AREAS WHERE GRAPHITE PARTICLES WERE REMOVED IN MOLTEN SALT BATH
BEARING BACKING (MEEHANITE CASTING)

in a low tin-content alloy (Meehanite Metal) which forms a uniform coating on the bearing surface. They are then placed in jigs and babbitt is poured against them, which forms the tight bond necessary to stand the pressure and stresses of big-engine operation.

"The bond is so uniform and strong", says the Corporation's Chief Metallurgist, "that we have been able to reduce the bearing thickness to a small fraction of the thickness formerly required." Experience shows that this bearing alloy stands up remarkably well under the most severe testing conditions.

The saving of tin is self-evident. It is also evident that this new development may eliminate machine grooving of the bearing backings—a time-consuming operation used to anchor the bearing to the castings. It also opens up new possibilities for cutting weight and saving Meehanite metal by reducing wall thickness of the castings.

FOXBORO STABILIZING CONTROL

1 *Reducing valve, which not only offers a means of remote control but, by mounting in the case, additional mounting arrangements are not required.*

2 *Control point setting is made by turning this knob. Very close settings can be made through the smooth friction drive on the edge of a sector.*

3 *Transfer switch; this air switch, built into the instrument, enables the process to be started up on manual control. The same air pressure that is applied to the control valve will be applied to the proportional-reset unit, therefore, when the process is in balance, it is necessary only to switch to Automatic and the process is on automatic control.*

4 *Reset or hyper reset has only four adjustment valves. These adjustments are not critical; no hairline setting is necessary.*

5 *Proportional bank is adjusted between zero and one hundred per cent by turning the knurled knob. A lock screw at the left of the knob permits locking against any change in adjustment.*

TIMED opportunely to the unusual requirements of industry at war, an important development in the field of control engineering was announced in 1942, by The Foxboro Company, under the name of "Hyper-Reset." This is not an instrument or a mechanism, but a rate sensitive function of the control action, available in the newly-designed Model 30 Stabilog Controller. This model, intended for temperature control applications in which process-lag is considerable, is proving of particular war-time importance in the refining of high octane gasolines and the production of synthetic rubber ingredients.

Hyper-Reset reduces the effect of a process disturbance by making initial, temporary, additional corrections which are proportional to the rates of change of the measured value, caused by the disturbance. The normal reset follows, establishing stabilization. In extensive tests "Hyper-Reset" consistently re-established process stabilization, following an upset, in one-quarter the time and with only one-half the upset effect, as compared with a similar controller having only the usual reset.

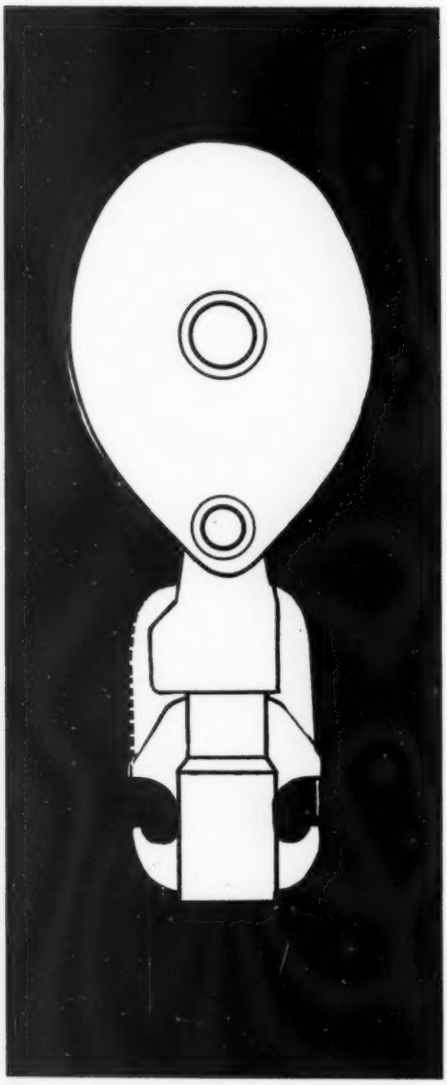
The control functions of the Model 30 instrument are simultaneous and are automatically adjusted; no tuning in is required. Operation is simple. When the door is opened, the operator has before him an operating panel in miniature. He needs only to set the control index to the required point, adjust the air supply pressure, and turn the transfer switch to "Manual." When the process is in balance the air switch is turned to "Automatic." Only in one case out of a hundred is it necessary to adjust the proportional band or the reset or Hyper-Reset values. However, if adjustments should be necessary, the setting devices are all in plain sight and immediately accessible without removing anything.

The most important function of an automatic controller on any process, but particularly on one having considerable process lag, is to stabilize that process rapidly, following a process disturbance. The upper graph is typical of the results obtainable from good proportional control with reset before the development of "Hyper-Reset." It shows recovery from one arbitrarily chosen upset. The lower graph shows the recovery curve for the same upset when "Hyper-Reset" is added to Proportional Control. Because stabilization is accomplished in one-fourth the time, the proportional band can safely be cut in half.

Putting a Model 30 Controller into operation is extremely simple. When the door is opened the operator has before him an operating panel in miniature. Nothing has to be done but adjust the air supply pressure, set the control index to the required control point and turn the transfer switch to Manual. In ninety-nine cases out of a hundred it is unnecessary to adjust the proportional band, or the rest or Hyper-Reset values. When the process is in balance, the air switch is turned to Automatic. If further adjustments are necessary, they are accessible without removing anything, not even the chart. Twelve years' experience on nearly every conceivable type of process makes it possible to predict the correct adjustments at the factory.

Baash-Ross Tool Co.

TODAY, more and more operators are adopting portable drilling and production rigs for a wide range of well applications, because these smaller units offer time and equipment-saving advantages. However, the cramped working space in these rigs frequently presents difficulties, particularly when conventional block and hook arrangements are used. Operations are slowed down by the constant danger of running



Baash-Ross unitized block assembly compared with conventional hook-up (dotted line). Note space saving compactness of unitized construction.

into the crown and the limited space often prevents use of longer, faster-to-handle pipe lengths.

Baash-Ross Unitized Blocks are designed to overcome this drawback. They are compact, saving extra feet of space that increases the convenience, speed, and safety of portable rig operations. Their reduced over-all height and rugged unitized construction permit full use of the derrick height, permitting faster round trips, allowing pipe to be swung out and racked easier, and enabling the crew to operate at normal working level when making and breaking connections.

There are many other ways these Baash-Ross Block Assemblies are providing new convenience, greater versatility and long, trouble-free service on portable operations everywhere.

Compact; reduced overall height dimensions of Unitized Block and Connector assembly.

Balanced; weight is concentrated in the lower end of the block, assuring travel in straight line motion.

Streamlined; there are no projections to catch on obstructions in the derrick or in workmen's clothing.

Free Running; sheaves are mounted on heavy-duty type roller bearings individually lubricated.

Easily Reeved; the single piece guard, positioned close to the sheaves, not only retains rope in place but serves as a guide when threading the line.

Versatile; interchangeability of Hook and Link Adapter assemblies with the Block, afford various combinations to meet particular requirements. The standard Block is available in one, two, and three sheave designs with a choice of 20 inch, 24 inch, and 30 inch diameter sheaves. Other specifications can be supplied on order.

✦

New Cleaner for Small Tubes

MR. O. J. Bagnoli, Vice-President and General Manager of Thomas C. Wilson, Inc., Long Island City, New York, announces the development of an entirely new and revolutionary type of tube cleaner on which patents are

pending. The new tube cleaner was especially designed to clean the small diameter tubes (⅜" to 1¼" I.D.) used in condensers, heat exchangers, and similar apparatus. The new tube cleaner renders obsolete tube cleaners operating at slow speeds and using ordinary type drills, which up to now have been generally used for cleaning small straight tubes.

This cleaner operates at high speed and uses a "cutter-bit" which it is stated, will not clog or jam so as to damage or break either the shaft or the "cutter-bit" itself. Its unusually high operating speed enables tubes which heretofore were considered unprofitable to clean because of the time and trouble involved to be cleaned quickly and economically. Entire bundles of tubes can be cleaned in a very short time, and frequently the removal of tube bundles from the shell is unnecessary. This latter feature is of the greatest value under the stress of war time production, when every minute that a heat exchanger is down for cleaning means a delay in plant production. In removing either soft, gummy, or moderately hard deposits, the new cleaner operates at speeds never before obtainable in the cleaning of small diameter tubes.

In conjunction with the development of the new tube cleaner, the Wilson engineers have designed an attachment which gives to the "cutter-bit" the combined movement of a rotary tube cleaner and a percussion hammer, by adding to the rotation of the "cutter-bit" a series of blows which quickly break up the hardest deposit, and also assist the "cutter-bit" to obtain a "bite" on the deposit. The attachment is operated by the air or steam used as the scavenging agent in the tube cleaner. Its use is also recommended for cleaning either partially or totally plugged tubes in which an especially hard deposit is encountered.

✦

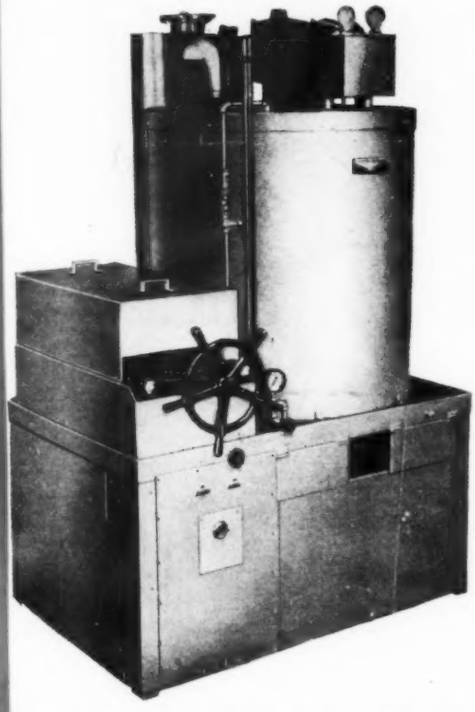
Selective Well Cleaning

A DEVICE for cleaning clogged perforations in a liner, lately developed in California, has been made the basis of a well cleaning service by Lane-Wells Company. It consists of a system by which a section of an explosive cord (known as Merical Cord) is lowered into a position opposite the clogged screen and exploded from the surface. The explosion generates an explosive force of sufficient power to thoroughly pulverize any deposit of cement in the slots, to liquefy mud or other drilling deposits, and dissolve paraffin, asphaltum or similar encrustations. The immediate result is an increased flow of oil which may amount to several hundred percent, depending on the degree of clogging and the thickness of the producing horizon. Particularly striking results have been obtained where the perforations were clogged with paraffin. One, two, or three sections of the cord may be used, according to circumstances. One cord is sufficient in 5½ in. or smaller casing, although two may do no harm if the liner is well supported by cement or formation cavings. In areas susceptible to sand trouble only one cord should be used, even in large casings.

For this service Lane-Wells has designed compact hoist units. These are 1-ton pick-ups to which a power take-off and hoist drum have been added. The drums carry 10,000 or more feet of rubber covered steel cable. A weight indicator and a measuring device are built into the automatic spooling equipment. Gun perforator trucks are sometimes used to operate the selective well cleaning service.

Youngstown Miller Co., Inc.

THE machine here figured is typical of the line of lubricating oil purifiers or reclaimers built by the Youngstown Miller Company, Sandusky, Ohio. Several of the pipe line companies are using this equipment to serve the diesel engines in their pumping stations. In some of the installations, a single YM serves several engines in a station. By the YM process fuel dilution is removed and the oil is restored each time it goes through the machine to substantially new oil values. The use of the machine eliminates the necessity of discarding oil and insures efficient engine operation by maintaining the oil at a high level of cleanliness.



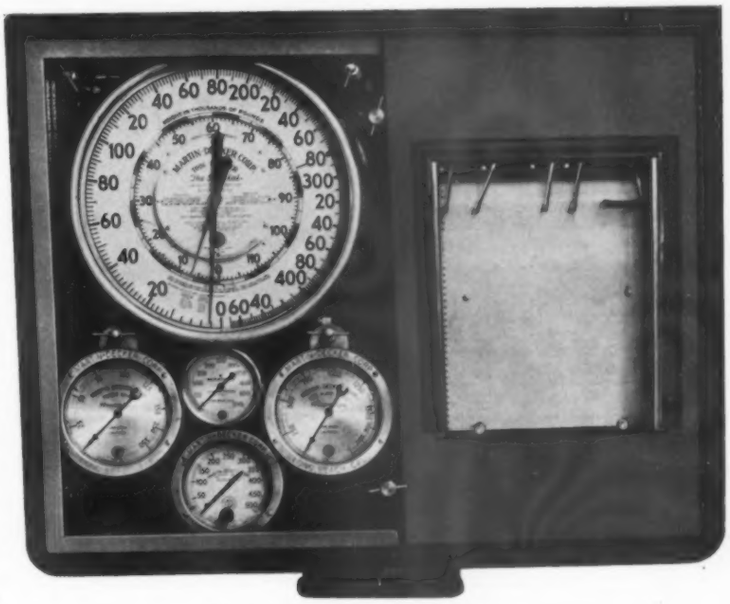
The machine pictured above has a capacity of 55 gallons of dirty oil in 80 minutes. While this is a very popular size, the machines are also built in larger and smaller sizes.

In addition to serving engines in pipe line pumping stations, the machines also serve hundreds of municipal and commercial power plants throughout the country, are used by several of the large diesel engine builders in their plants, and commonly installed aboard tugs and tankers to serve their diesel engines. Other interesting and worthwhile applications for this equipment is the restoring of transformer oils and tube oils used in compressors.

The machines are extremely simple to operate. The dirty oil is charged to the reclaimer with a motor driven dirty oil pump that has an automatic float control which controls the quantity pumped into the machine. The operator next adds a bulk refiners earth. The design of the machine permits the use of any of the many such earths available on the open market. The operator now turns on the switch which starts the electric heaters and agitator motor. The machine is now in operation under thermostatic control so that the operator is free to attend to other duties. When the mixture of heated oil and earth reaches the proper temperature, signal lights indicate to the operator when the batch is ready for delivery to finished tanks through the filter press which separates the oil from the dirty earth. The earth remains, together with the contaminants removed from the oil, in the filter press as a dry cake.

MARTIN-DECKER CORP.

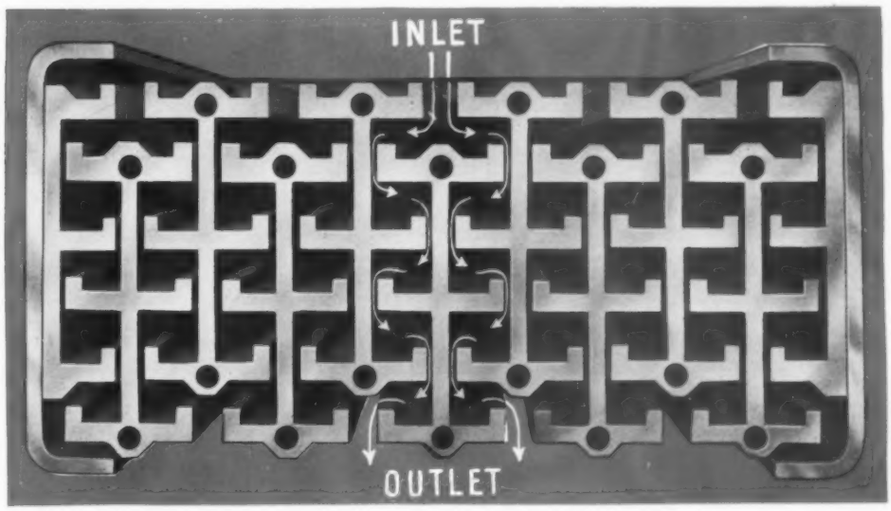
MARTIN-DECKER Corporation has recently changed the position of the permanent record on their drillogger. By reshaping the steel box, the strip chart is brought alongside the gauges. This new arrangement groups all drilling information together in a position where the driller can watch it with greater ease and visibility.



The new Martin-Decker Drillogger.

The drillogger still retains all of its original features, such as recording simultaneously weight on bit, table speed, mud pressure, torque in drill pipes, and rate of penetration, the only change that has been made in the instrument being the position of the strip chart.

FLUOR CORPORATION



THE Fluor Corporation, Los Angeles, has recently introduced a complete new line of gas cleaners, which includes a vertical liquid removal type, a vertical solids removal type, and a horizontal liquid removal type. The heart of the new Fluor gas cleaners is the separator element consisting of a grouping of T-faced webs which form a maze that forces the gas stream to repeatedly change its direction of flow and presents a multitude of impinging surfaces which accumulate and drain off the captured liquid.

The flow through the vertical liquid removal type is directly against a distributing plate to secure equal distribution of gas or vapor through the entire separator element which is sealed top, bottom and sides to confine the gas flow to the scrubbing section of the cleaner. The maze

arrangement of the T-faced webs forces two separate actions: repeated change of direction of flow, causing separation of the entrained liquid particles; and impingement of the separated liquid particles upon the web faces. Liquid so accumulated is drained by gravity from the scrubbing section into the reservoir at the base for removal.

The vertical solids removal type is divided into two separate chambers, an oil bath and sludge reservoir chamber and a liquid removal chamber. Dirt-laden gas enters the vessel at the side and is diverted downward into the oil bath where intimate contact between the gas and scrubbing oil removes all solids. Particles of dust and dirt gradually settle to the bottom of the cleaner as a sludge which can be removed through the drain as often as required. Entrained oil from the dirt removal chamber is separated from the gas in the liquid removal chamber and returned to the oil bath chamber. One of the features of this type is that scrubbing oil loss is confined only to that resulting from evaporation.

✦

S. R. Bowen Co.

A GENERAL practice among operators today is the use of drill collars larger in diameter than the tool joints on the drill pipe. This has presented a major fishing problem because in case of a twistoff the operator must be prepared to catch any one of *three* sizes.

The Series 300 Bowen Releasing Overshot has been especially made for such fishing conditions, providing in one unit all grapple sizes required for the combination in the hole. It is assembled together as a three-bowl tool and without changes or adjustments is ready to run to catch and pack off drill pipe, tool joint or drill collar.

One popular size Overshot, for example, will catch 4½ inch OD drill pipe, 5¾ inch OD tool joints and 7 inch OD drill collar, whichever is up. Overshots with five bowls are in successful use.

The Series 300 Overshot incorporates features identical to other Bowen multiple-bowl types. It has the unique helical gripping members called grapples, each of which provides a full-length slip-proof grip as soon as it is over the fish. The gripping action is completely independent of mechanical operations other than rotating and lowering the tool over the fish. The tool carries three packers for packing off all three sizes, and a milling member for rounding up ragged ends of the drill pipe.

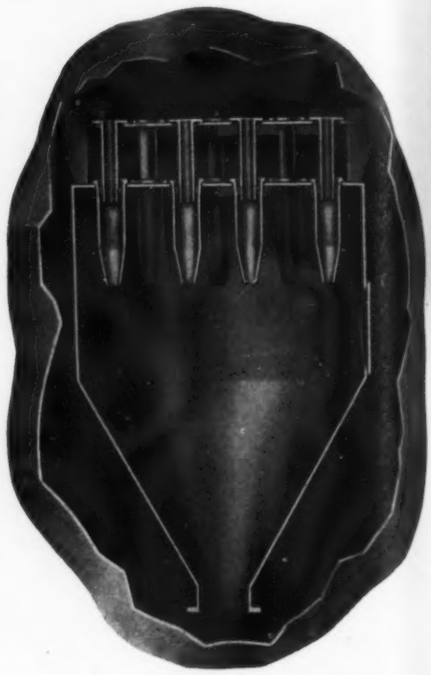
✦

Western Precipitation Corp.

BEFORE the new fluid catalytic cracking process could be deemed acceptable as a refining process it was necessary to solve the problem of recovering the extremely fine spent catalyst from the stream of hot gases that were subjected to unusually high temperatures and operating pressures. Western Precipitation Corporation was called on to participate in this development. Starting with a pilot plant the engineers of this Corporation collaborated with the refining engineers, and the first full-sized catalytic cracking plant went into successful operation equipped with Multiclones.

A VS Multiclone Assembly is shown in the accompanying illustration. The Multiclone consists essentially of a plurality of tubes, each tube having a conical dust discharge outlet at the bottom and a directional inlet vane at the top. Dust-laden incoming gas is first divided into eight separate streams by the vane in the top of each collector tube. This vane is the heart of the unit and imparts centrifugal motion to the gas and at the same time provides a downward component so that as separation progresses the dust is continuously discharged from the bottom of the tube and the clean gas exits through the clean gas outlet tube at the top.

The Multiclone removes the great bulk of the powdered catalyst. The remainder, amounting to less than one percent of the whole mass, consists of ultra fine particles that only a Cottrell Precipitator will throw down. Combined with a Cottrell Precipitator, the Multiclone has resulted in an overall efficiency approaching the theoretical 100 percent.



VS Multiclone Assembly.

Neutron Curves — A Newer Aid In Well Surveying

THE system of neutron logging recently developed by Lane-Wells Company has definitely taken a place among scientific devices for gaining knowledge of underground conditions. A neutron survey made by the Lane-Wells Neutron Logging Instrument gives a record that reflects features not readily apparent in a resistivity log. One important use of the neutron log is in locating dense limestones or hard sandstones. Another useful feature of the neutron log is its ability to indicate porous zones in a uniform limestone formation. A third useful feature is in determining the casing seat. Generally speaking, shales exhibit the lowest intensity on the neutron log and may be used as a reference value or base line. An important use is to check depth measurements of electrical logs. Satisfactory logs may be made either with or without fluid in the hole.

The neutron curve may be used alone to solve certain problems regarding subsurface formations behind casing, or as a companion curve to the Gamma-Ray Curve, which is also a recent Lane-Wells development. When used in this combination the gamma ray defines the thickness of a limestone formation while the porous zones of the limestones are defined from the low intensity values of the neutron log.

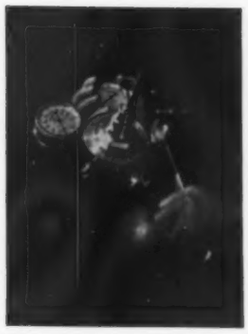
The equipment used for neutron logging consists of a hoist truck, and instrument truck and an electrical cable on which the instrument is suspended. The average recording speed is 1,000 feet per hour, and the complete log is available immediately upon completion of the survey.

Victor Equipment Company

Steps in assembling a Victor welding or cutting unit.

Have your oxygen and acetylene cylinders in a handy place.

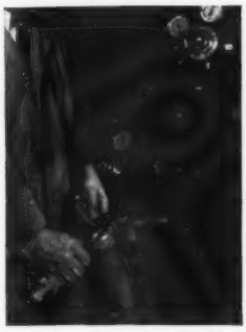
Put the acetylene valve wrench in place.



Connect one end of the oxygen nose to the oxygen regulator.

Connect the other end of the oxygen hose to the oxygen inlet on the torch.

Blow out the hose to clean it of any dirt or dust.



Connect the free end of the oxygen hose onto the oxygen inlet nipple. Likewise connect the acetylene hose to the acetlyene regulator and torch.

Select the torch tip suitable for the job.

Partially open the oxygen torch needle valve and adjust to proper gage pressure; then close the torch oxygen needle valve.

Likewise adjust the acetylene gas pressure.

Open the acetylene valve further until the flame stops smoking; then open the torch oxygen valve to produce the desired bright, inner flame cone.

Climax Engineering Co.

CLIMAX ENGINEERING COMPANY, Clinton, Iowa announces the new V-12 Blue Streak Engine, the latest addition to the extensive line of the company's engines and engine-generator sets.

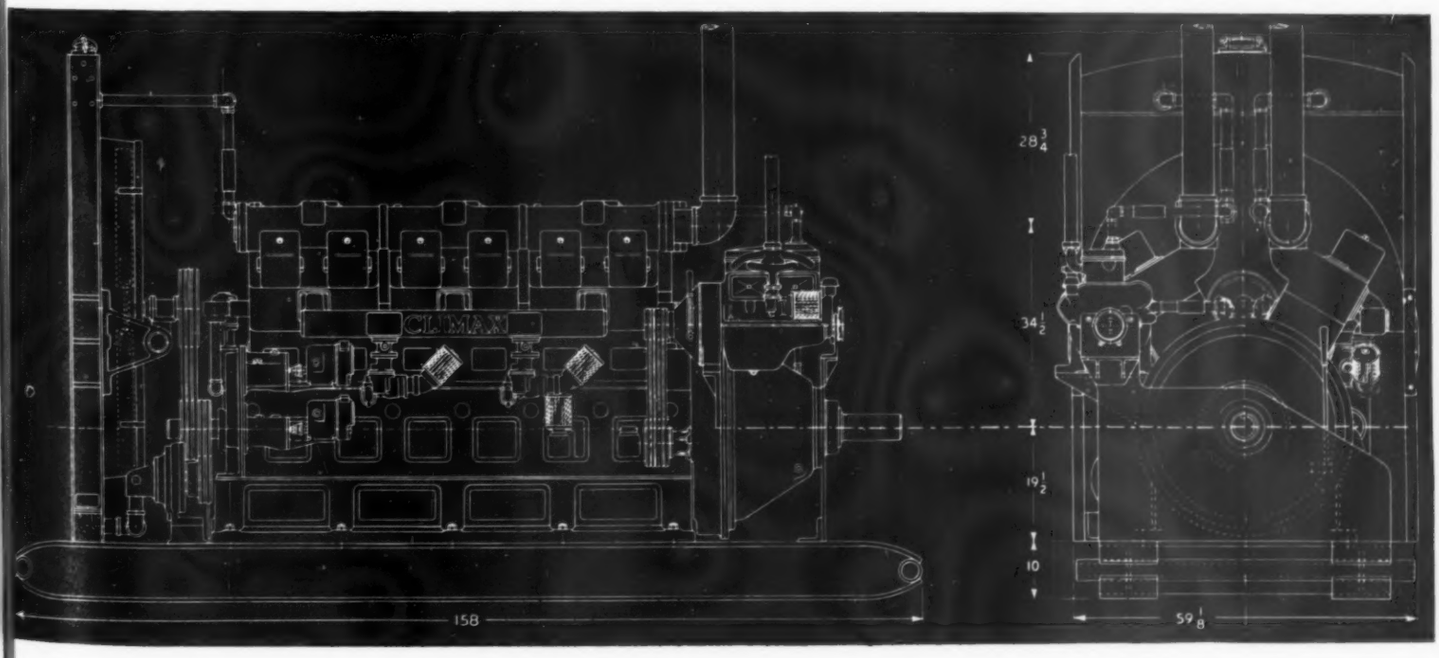
With a normal speed range of 600 to 1200 r.p.m. and a brake horsepower of 435, the new V-12 meets today's demands for a high speed engine which will mesh with modern power consuming machinery for rock or oil drilling, operating large pumps and compressors, driving mining and construction machinery and, with suitable generators, a low cost means of generating electric power. For oil field service the new Climax V-12 engine is an ideal power unit for deepwell oil drilling, oil well and pipe line pumping and for stationary power and construction service.

The Climax new V-12 is available in two bores. Model V-335, 6½ inch bore and 7 inch stroke develops 375 hp. at 1200 r.p.m. Model V-390 with a 7 inch bore and 7 inch stroke develops 435 hp. at 1200 r.p.m.

Dual ignition can be furnished in the following combinations:

Dual battery ignition
Dual magneto ignition
Dual battery and magneto ignition

Standard design features include wet cylinder sleeves, seven-bearing crankshaft, overhead valves, aluminum (5 ring) pistons, rifle drilled connecting rod and fuel change-over devices.



MULTIPLE ZONE WELLS

Hold Established Place in Producing Practice

To Economies of Drilling and Operation Which Led to Extensive Adoption Under Normal Conditions Is Added Saving in Critical Materials Important in Present Emergency.

By Dr. O. W. Wilcox

AS A SERVANT of the public interest, the production branch of the oil industry is at this moment faced by two imperative demands. First, to produce more oil, and at the same time, to do it with less use of critical materials (meaning mostly steel) and with less labor, of which there is also a critical shortage.

In the period before December, 1941, when the Japs dragged this country into the global war that is now raging, the first appearance of a shortage of oil, or of a sign that oil consumption was beginning to eat into reserves, would bring out more geophysical crews; more wildcatters would risk their money in the hope of finding new pools, and producing fields would be extended by drilling more wells. But that normal picture has been altered. For one thing, considerations of public policy as interpreted by the OPA has been keeping down the price of oil. That policy of itself has acted to dampen incentive to look for new oil, and other deterrent factors have not been lacking. The war has drained away many of the geophysical personnel, leaving hardly enough trained men to do even the work that is advisable under the circumstances. Drilling crews are more or less depleted, and wages are going up. The price of oil country equipment is also going up, and under the iron rule of WPB not much of it is even in sight.

Over and above these deterrents on new drilling stand the laws and regulations that in general limit the spacing of oil wells to one to 40 acres. Before this limitation came into effect an operator could drill as many wells on his lease as he pleased; the more wells he had (within reason) the sooner he could exhaust his oil sand and save on overhead. But that too has passed. Spacing restrictions are imposed partly as a conservation measure to insure maximum ultimate recovery, and partly to prevent the drilling of "unnecessary wells" that consume critical materials. Besides all this is the matter of proration, or well allowables, which has been imposed by law and accepted by the industry as a necessary measure for orderly marketing.

It all adds up to a restriction not only on the discovery and exploitation of new oil fields, but also to a decrease in the amount and an increase in the cost of the oil that may be regularly produced from a given well or lease. Naturally enough, this situation has driven oil men to consider how they might produce more oil from their wells and leases within the limits imposed by spacing, by allowables, by the shortage of critical materials and labor, and by rising costs.

This conjunction of adverse circumstances has lately evoked renewed interest in what are known as multiple-zone wells. In many fields the drill may and often does pass through several oil sands at different levels. Each of these zones is tested and the well is bottomed in the zone that offers commercial production. When this zone is depleted the usual course is to deepen the hole in a search for lower oil horizons, or the well may be plugged back and production taken from an upper zone that was previously cased off.

It is obvious that completing a drilled hole in only one zone does not make immediate and full use of the potentialities of a lease. If two separate zones are capable of producing the same amount of oil taken singly, the well might produce twice as much if both zones are produced simultaneously. This is the idea behind multiple-zone completions. Putting the idea into practical effect is, basically, a simple matter. In the case of a two-zone well the two zones are separated inside and out the lines by a packer; the lower zone is produced through the tubing and the upper one through the annular space. In some cases a variety of circumstances may introduce complications.

Oil wells have been complete as multiple zone wells in California, the Gulf Coast, East Texas, West Texas, Oklahoma, Kansas, Illinois and Arkansas-North Louisiana. In California these multiple-zone completions have been especially numerous in the Wilmington field—264 out of a total of 974 wells in the district. According to Robert F. Corey, who reviewed Californian multiple-zone practice before the 1941 meeting of the A.P.I. at Chicago, the operation in the Wilmington field has been generally successful, accounting for 43.6 percent of the total production of this field.

The reasons for this development in California are, first, the presence of several zones (in some cases as many as 8). Much of Californian production comes from relatively deep wells; to drill into and produce each zone from a separate well would mean a large expense. Experience has shown that the cost of drilling and completing a well for multiple-zone production from two sands is less than the cost of drilling and equipping two separate wells to these sands. This saving in initial cost is in fact one of the principal arguments in favor of multiple-zone completions. There are other reasons which have turned some California operators in this direction—the competition of town lot drilling is one. Where numerous wells on numerous adjoining leases penetrate the same succession of oil sands an operator cannot afford to confine himself to one sand while competitors with multiple-zone wells drain away the oil from his other sands. This argument is valid for offsets in other regions.

Another argument for multiple-zone completions stems from proration regulations concerning curtailment and allowables. Where the allowable is fixed by the well's potential under open flow it is the operator's natural desire to show as high a potential as possible. The combined flow of two oil sands may make a better showing than either alone. When all zones together have been used to establish potential the well's allowable may be produced from the zone or zones yielding the most valuable oil. Again, the presence of a high gas/oil ration may prevent a high allowable. In that case, after potential is established the operator may choose the zone with the lowest gas/oil ratio. In cases where an allowable is assigned to the lease, a few multiple-zone wells may produce the allotment for the entire lease. In making a selection of zones the one that is most easily produced will be chosen. Still another reason for multiple-zone completion comes up when one zone has energy enough to produce itself by natural flow and another zone is deficient in such energy. In that case, gas from the first zone may be used to lift the oil from the other one. Finally, there is the case where the drill may pass through several oil sands, none of which offers profitable production by itself. But when two or more sands in such wells are produced together the investment as a whole may be preserved.

In certain cases all oil horizons penetrated by the drill may be produced from the same hole without any separation of the zones. In such cases all that is or would be necessary is to complete the well as usual in the bottom sand, perforate the casing opposite each zone and connect the well to the gathering lines. But this ideal condition depends on local circumstances. In the first place the oils of the different sands may not be of the same quality and gravity; for various reasons some states prohibit the commingling of oil from different zones. One or more may have res-

ervoir energy enough to be produced by natural flow, others not; some may be high and others low in gas/oil ratio. Where there are pressure differences and the pressure has to be controlled at the surface, the excess pressure in one zone may force oil into a lower pressure zone where it will be a direct loss to the operator and a distinct benefit to an adjoining competitor. Further, an upper zone may produce more water, which would have a tendency to drown out the lower, water-free zones; by producing the watery zone separately, it will be possible to dehydrate the oil from this zone by itself, thus keeping down operating expense. Again, one zone may produce excessive sand, but by producing this zone separately from the rest the sand as well as the encroachment of edge water may be controlled.

As was said above a multiple-zone well is on the whole a simple proposition. In many cases it is only required that the zones be separated inside and outside the lines, so that production from each zone may be controlled separately.

The simplest case is illustrated in the accompanying figure, copied from a report by Alcorn and Alexander to the November 1942 meeting of the API, which shows an upper and a lower oil zone separated by a non-removable type of packer; the lower zone is produced through the tubing and the upper zone through the annular space. The profile on the right shows a dual-well completion where the two flows are kept separate; the one on the left indicates completion of the well to permit commingling of production where this is desirable, as when the energy of one zone is used to produce the other zone. For this commingling the tubing is provided with an upper side-door or unloading valve. The only differences from ordinary completions are therefore the presence of the separating packer and the unloading valve.

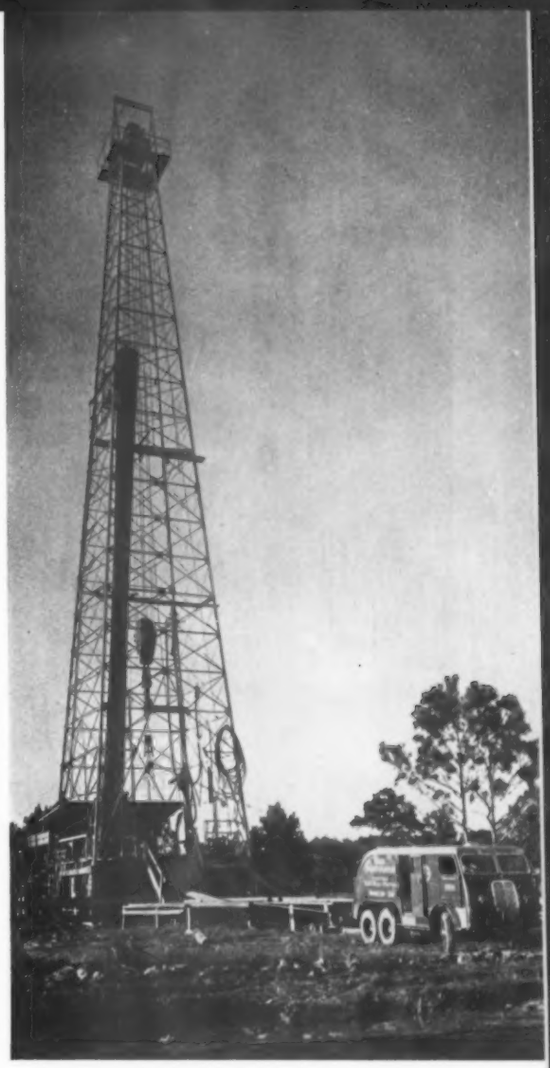
Separation of the zones outside the casing requires that cement be placed between the zones outside the lines. This is done either by cementing blank pipe through the zones and perforating the pipe in the hole, by cementing blank pipe between the zones, or by a combination of both. The first alternative, involving perforating the pipe in the hole, presents no special difficulties. Cementing blank pipe between two perforated sections is more difficult because separation of the zones must be attained; and cement must not be allowed to plug the perforations or clog the face of the sand. When intermediate water is present between the zones a water shut-off must be obtained above and below this water. The technique of cementing as many blank sections as desired is described by Corey.

The above is for a dual-well completion. The case for a three-zone well is on the whole similar. When subsurface control is applied, three-zone separation is achieved by using two packers on the tubing. Where production is controlled at the surface a flow string must be set with a packer between the top and middle zones; the middle and bottom zones are separated by a packer on the tubing, as in a two-zone well. It is this separation of the zones outside the lines that is the chief problem in drilling a multiple-zone well. The best method of cementing depends on the special conditions found in the field and the well, so no general procedure can be given in detail. Recementing is sometimes necessary but the majority of cement jobs give no trouble. Multiple-zone wells have been completed with casings ranging from 8⅝ inches down to 5½ inches.

The arguments for multiple-zone completions have already been summarized above. Chief among these advantages is obtaining more production than can be had from a single-sand well, at a cost that is less than the cost of separate wells to two or more sands. The economies effected are in the nature of reduced drilling costs, savings in casing and tubing, drilling equipment, lease roads, flow lines, dredging canals, derricks, pumping units, etc. In most instances a standard casing program may be followed. From information obtained by Alcorn and Alexander on multiple-zone completions in the Mid-Continent it appears that the initial completion of wells in more than one producing zone may be expected to result in a saving of about 45 percent in steel consumption, and approximately 40 percent in drilling costs as compared to the drilling of two standard wells.

While, generally speaking, it is felt that this type of completion offers promise of being entirely satisfactory under conditions where consolidated productive formations exist and where final fluid volumes handled will come within the limits of the permanent equipment in the well, it does not follow that a successful initial multiple-zone completion ultimately will yield as satisfactory results as would single wells to the individual zones. On the other hand, when serious operating problems can be foreseen, resorting to a multiple-zone completion might be a questionable adventure.

When a multiple-zone well has been completed and turned over to the operator, the production of oil therefrom may be easy or troublesome, depending on circumstances. The ideal condition is where all the zones can be produced by natural flow, or under the steady flow of a repressuring project, and if there is no sand trouble present anywhere. Sand trouble will be at a minimum when the consolidated formations referred to above are porous limestones or a more or a less compacted sandstone from which granular sand will not flow into the hole with the oil. In that case and with natural flow, production will proceed as in any normal new well, with the oil flow controlled either at the surface or by means of bottom chokes. But this ideal is not always encountered. The operators of single sand wells are familiar enough with sand trouble; a multiple-zone well is more complex; a dual-well may be exposed to twice as much sand trouble as a single well with some extra trouble thrown in. There are more passages to be clogged with sand. Sand blasting may nullify the separatory function of the packers, eating through the tubing and



Gun perforating servicing outfit working in the field. Photo courtesy Lane Wells.

opening unrestricted communications between the zones. In one case this happened within three hours after a multiple-zone well was put on production. The packers themselves may leak or fail to set; where a good set has been obtained there are no leaks around the packers. Sand cleanout jobs may assume major proportions; a few feet of sand may make it impossible to remove a packer. In the Mid-Continent an effort is made to counteract sand blasting by covering the tubing opposite the upper zone with a rubber or pipe sleeve. Due to success in a technique of setting packers developed in the Mid-Continent, particularly Kansas, there is no evidence of the commingling of zones from leakage around the packers. Frequent workovers may be necessary if all zones are not screened to cope with the sand nuisance. Still, these difficulties have not yet been regarded as very serious, and such as have been encountered are considered to be offset by the lower cost of the multiple-zone well and the reduced overhead.

As was said above, the ideal production situation is where all zones are under reservoir pressure and the oil comes to the surface by natural flow. If one zone does not flow it may be produced by gas lift from another zone. But where none of the zones has natural flow, pumping a multiple-zone well may be a serious problem unless conditions are ideal, as they are in Illinois (see below). Different zones have been pumped sep-

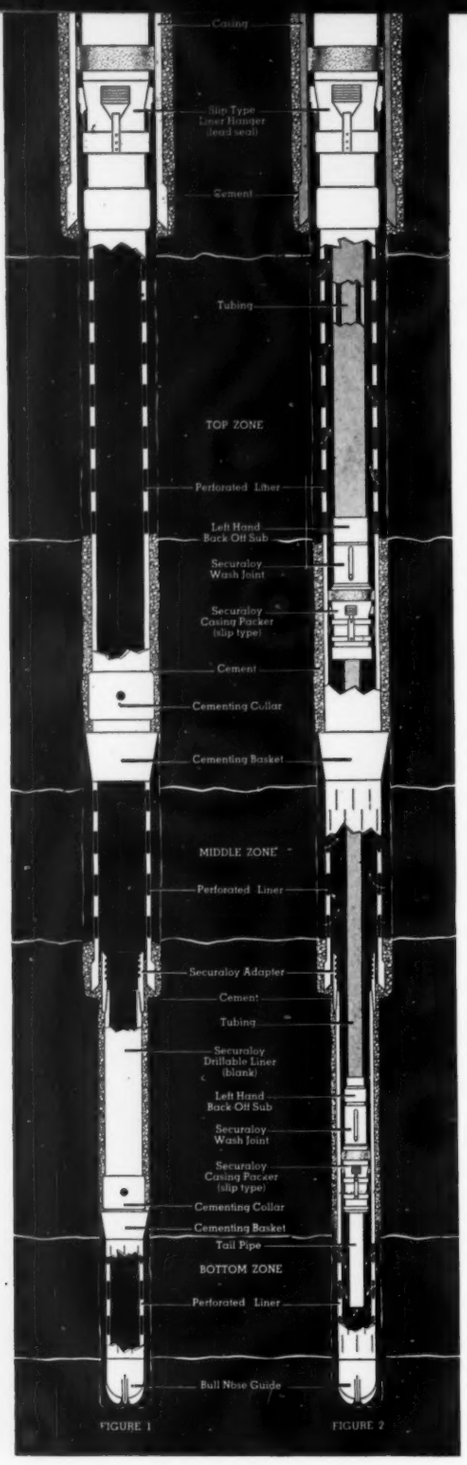


FIGURE 1 FIGURE 2

arately under very special conditions, but there are many possibilities for trouble, especially in that case all oil and gas go through the pump; and gas lock becomes likely unless the gas/oil ratio is very low. The easiest way out when two zones have to be pumped is to produce them one at a time, say the lower zone during the first half and the upper zone during the latter half of the month. After the lower zone has been pumped for 15 days the tubing is raised to bring the perforations above the packer.

Notwithstanding the development of multiple-zone completions in the Wilmington field, the present trend in California is, according to Corey, away from this practice. He says this is due partly to the approach of the end of the flowing life. It will be remembered that a multiple-zone well is at its best when all zones are produced by natural flow; when the pumping phase is reached, difficulties which may be more or less serious begin to make their appearance. Again, the competitive area in that region is now largely drilled up, removing one of the principle reasons for multiple-zone wells from consideration in connection with new drillings. However, even in undrained areas separated from competition by faults, the trend is also away from multiple-zone completions because of a feeling that additional recovery may be expected by using separate wells to each zone. What basis this feeling has in experience is not quite clear. At any rate, it now appears that for one reason or another some of the multiple-zone wells in California are now producing from one zone only, even though the original completion was in two or three zones.

On the other hand, the practice seems to be holding up better in the Mid-Continent areas, where conditions differ from those in California in respect of regulations governing completion practices, wide variance in proration plans, especially with regard to potential ratings, and non-uniformity in production reservoir characteristics such as nature and thickness of producing zones, viscosities of oils, etc. In the Mid-Continent the dominant motive has been the savings to be made in first cost. And while the California operators have been reporting considerable difficulty in artificially lifting their multiple-zone wells, no such operating difficulty has been reported from Kansas wells on which data has been furnished. The contrasting experience in these two areas would seem to emphasize the fact that local conditions may be the governing factor in artificially lifting multiple-zone wells. Any oilman will understand that every oil field is a problem in itself. However, only a small proportion of the multiple-zone wells with packer separation in the Mid-Continent have yet reached the stage of artificial lift.

According to an unpublished report prepared by R. J. Sullivan and Marshall Joy for the Eastern Topical Committees of the API on Production Practice and Drilling Practice, multiple-zone wells in the Illinois Basin appear to be the rule rather than the exception. Here there are several productive zones in the same section, some of them close together and differing in permeability. Intensive development of this basin began in 1938, and from the start the practice of producing more than one formation through the same casing string had become commonplace in many forms, even before World War II focused the attention of the oil men on the necessity of husbanding materials. Within the past year the practice has become even more widespread in this basin. The local name for the multiple-zone technique in Illinois is "casing window practice." By this is meant that a "window" is opened in the casing opposite each oil zone. Before aluminum-magnesium alloys became scarce that part of the casting string opposite the oil sand was composed of such an alloy, and after completion was easily removed and the formation shot with nitroglycerine. Now the temporary window is made of light steel which can be cut or milled out, or the section opposite the sand is gun-perforated.

It is not often that the Illinois producers make any effort to prevent mingling of the production from a plurality of pay horizons in the same well bore. In most instances these horizons are near enough to one another so that little would be gained by separation of the production. Again, flowing life is so brief that sucker-rod pumping must soon be resorted to, and this brings up the problem of simultaneously pumping two or more zones. However, in cases where the lowermost pay is a sand or limestone so highly permeable and so heavily produced in the vicinity (competitive pumping) that a "thieving" action is taking place between pays, some operators have successfully undertaken the installation of a packer equipped with a standing valve between pays, or have otherwise pumped their wells so that a production packer will not permit the movement of fluid from one formation to another.

A smaller number of Illinois installations have been made to take flowing production from one formation while the other is being pumped, but these arrangements have been of a temporary nature. In the Salem, Loudon and New Harmony pools gun-perforation of multiple pays is employed to conduct high pressure gas in separately controlled streams to oil sands for lifting purposes. Single or multiple packer arrangements are needed in such instances.

Sullivan and Joy conclude by remarking that the ready acceptance of the multiple-well over a relatively brief time is measure enough of the method's basic soundness and serviceability. On the one hand failure has been relatively infrequent and production results have been good enough to accelerate progress consistently. In their opinion, "its plainly fortunate advancement prior to the war emergency has brought the technique to a place where the multiple-zone method of completing wells now stands as a most important factor in the industry's war-time operations."

Summarizing the broad aspects of multiple-zone wells based on experience to date, it appears to be settled as a general rule that the initial separate completion of wells in more than one zone can be accomplished successfully. Such completions may be expected to result in a saving of about 45 percent in steel consumption, and about 42 percent in drilling costs as compared with the drilling of two standard wells. However, it may be borne in mind that the practice of multiple-zone completions is still in its early stage of development. A good deal of data covering the stage of natural flow is at hand, but experience on the later life of these wells, especially the final stage of artificial lift, is not as yet sufficient to permit drawing definite conclusions as to the ultimate overall practicability of the method.

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JERSEY STANDARD GIVES BUNA PATENTS TO U. S.

RALPH W. GALLAGHER, president of Standard Oil Company (N. J.), announced April 20 that the company had offered, subject to approval by its stockholders, to give to the government of the United States, through Rubber Reserve Company, permanent ownership and control of all its patent rights on Buna rubber. These patents include the rights acquired from I. G. Farbenindustrie just prior to the war, together with a number of patents developed by Standard through its own research and experimentation, numbering one hundred or more, which run for varying periods up to 1951 and beyond. Under an existing agreement they are available royalty free during the war to any company desiring to make use of them. The purpose of the present offer, which has been accepted by Rubber Director Jeffers and by Reconstruction Finance Chairman Jesse Jones acting in behalf of Rubber Reserve Company, is to encourage the fullest development of Buna-S which is the basis of the government's synthetic rubber program without the limitation that might be imposed by restriction of free use of the patents to the period of the war.

As set forth in the letter addressed to Director Jeffers by President Gallagher the plan proposed by the Standard Company includes the following main points:

"Rubber Reserve Company would have a free license for itself, not only for the war but for the life of the patents.

"Rubber Reserve Company would also have the right to issue perpetual free licenses to everyone who cooperates with the government in its war rubber program and who reciprocates with similar licenses under its own patents.

"Under this offer there would be no payment to us or to others for the patent rights used, but the government would agree to continue and expand its expenditures for research in the synthetic rubber field up to an aggregate amount of not less than $5,000,000."

In response to this letter Director Jeffers wrote in part: "Your proposal is, I feel, very definitely in the public interest, and this is an eminently propitious time to make this offer. Plants to make raw materials for synthetic rubber are coming into production. Two of the so-called 'Standard design' copolymer plants for the manufacture of Buna-S have made synthetic rubber of better quality than was, until recently, thought possible. However, there are other uses for which the present-day synthetic rubber does not fully replace crude rubber, and it is not the way of American scientists to be content with today's quality. The synthetic rubbers of the future will be of better and better quality. It is appropriate that everything possible be done to hasten this improvement.

"Your proposal provides the necessary foundation for a general plan of free licenses under the patent rights of all American industry directly bearing on a very important part of our program and I earnestly hope that your example will lead others to join promptly in this effort."

In his announcement of Standard's action in placing at the service of the public, through the government, all its rights to Buna-S rubber President Gallagher explained that the company's interest in synthetic rubber, aside from its immediate war applications, was primarily to keep the nation's motor vehicles equipped with tires and thereby to maintain a market for gasoline and oil, the company's main products. The manufacture of butadiene, he pointed out, was of slight importance to the petroleum industry as an outlet for its products since the entire amount required for the full rubber program of the government was only about six-tenths of one percent of the normal output of oil. Whether the raw materials for synthetic rubber were to come from oil or alcohol was of minor concern to the petroleum industry compared to the importance of keeping the country's cars equipped with tires.

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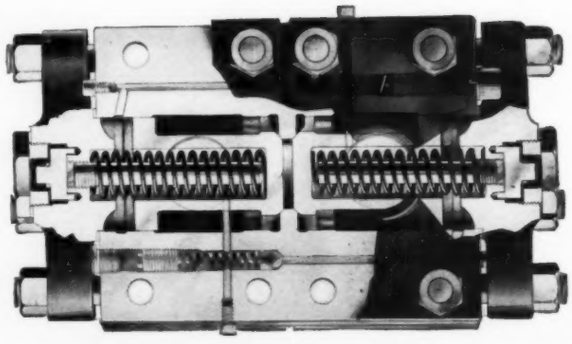

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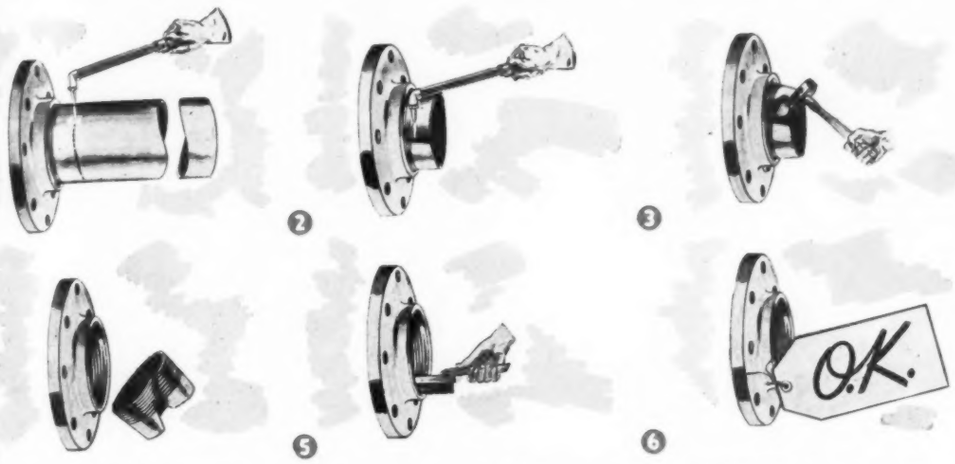
DURING the present emergency more than ever before, our nation requires that every Diesel engine owner get the best possible performance from his engine. To help the operators of these engines to perform this, engineers of the International Harvester Company have prepared the following catechism, which the operators should carefully read, and then determine on their conscience, whether they are doing their part.

1. Lubrication. (a) Use only well refined oils, free from water, sediment, acid resin or any other substances not derived from petroleum. (b) Use oil of viscosity of S.A.E. number recommended by manufacturer. (c) Exert care in storage and handling of oil; keep clean. (d) Drain and refill both engine and injection pump with new oil every 100 hours of engine operation. Install new filter element making sure to clean inside surfaces of filter case and base at time of changing filter. (e) Refer to lubrication chart in Owner's Manual for oiling and greasing instructions.

2. Fuel Oil. (a) Use only clean fuel; use care in storage and handling. (b) Do not use a lower grade fuel than specified by manufacturer. (c) Clean fuel oil water trap when there is any indication of water in the water trap bowl. (d) Clean fuel oil filter or replace with new element, depending on type of filter used, whenever a loss of power is noticed or the engine misses at full load.



Left: (1) Cut pipe near flange; (2) Cut "V" shaped notch in pipe remaining in flange; (3) Collapse pipe with hammer blows, as shown; (4) Pipe falls out of flange leaving flange threads unharmed; (5) Clean threads thoroughly; (6) O.K. for reuse.

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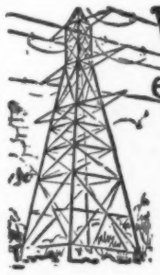

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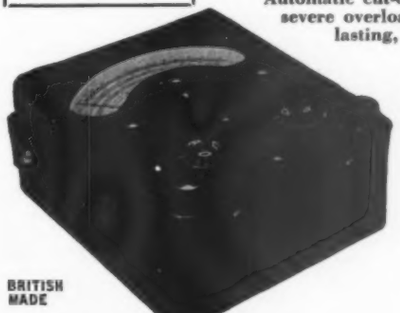

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5. Instructions for starting in all weather should be clearly understood and followed by operator.

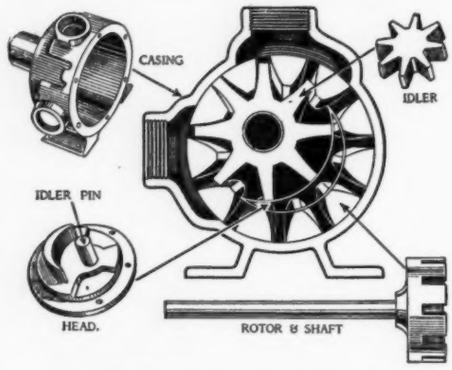
6. All seals must work effectively to prevent entrance of dirt or loss of oil.

Full information on these points is contained in two publications issued by International Harvester Company: "International Diesel Engine Maintenance Suggestions," and "Keeping 'Em Rolling."

Viking Rotary Pumps

THE ordinary centrifugal pump is a valuable piece of equipment for work to which it is adapted but it has its limitations, the chief of which is that it "races" and ceases to deliver when operating against pressures above a certain maximum. To overcome this limitation and retain the advantages of the centrifugal pump, increasing use is being made of rotary pumps, such as the rotary pump fabricated by the Viking Pump Company. The construction of a Viking Rotary pump is outlined in the accompanying diagram.

With every revolution of the pump shaft a definite amount of liquid is drawn into the pump, filling the spaces between the teeth in the idler and rotor as they pass the inlet port. The liquid is forced out of the spaces into the outlet or discharge port by the meshing of the teeth at a point midway between the two ports. The



amount pumped per minute varies in direct proportion to the revolutions per minute of the pump shaft. Like any other piece of equipment designed to do certain work in a certain way, a Viking rotary pump needs to be correctly installed and conscientiously operated.

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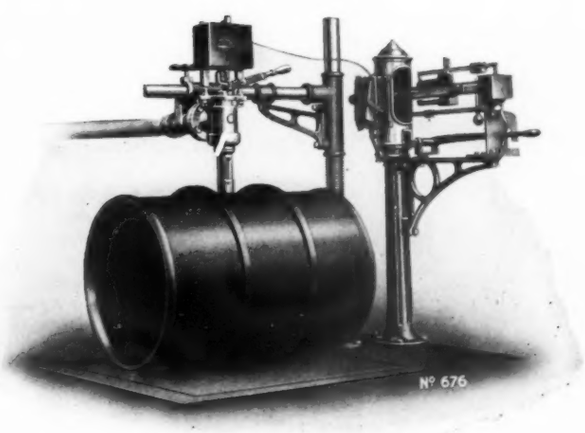

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WORLD PETROLEUM ABSTRACTS

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing with Technical and Economic Aspects of the Petroleum Industry—Edited by Dr. O. W. Willcox.

DRILLING

Proper Completion by Radioactivity Logs — John J. Neale, in OIL WORLD, Vol. 36, (1943), No. 6, pp. 10-11.

Whenever subsurface conditions make it desirable to cement a string of casing through a productive zone and then gun-perforate for production, much depends on the accuracy of logging. Measurements taken while drilling or coring do not always check with the electrical log, and when the actual oil-bearing stratum is thin the error of a few feet in the placement of the production shots may make the difference between a successful and an unsuccessful operation. The case becomes more particular when water is adjacent to production, which may make another squeeze job necessary in addition to a second gun-perforating job.

In a Louisiana field it was observed that driller's measurements to the tops and bottoms of the sands usually differed from electrical log measurements by 3 to 6 feet. To resolve this discrepancy it has become standard practice in this field to run a radioactivity log (gamma ray curve) after the casing has been set; all squeeze and gun-perforating jobs are then done on the basis of data furnished by the radioactivity log. Experience has proved that the squeeze shots can be positioned in the right place the first time.

The author states that there have been numerous radioactivity logs run in this area for the purpose of checking measurements; and good correlation has been obtained in every case. With such correlation the gamma ray curve gives added assurance that the subsurface data are reliable; and it provides a sure means of placing the perforations just where they are wanted.

DIFFICULT DRILLING PROBLEMS SOLVED WITH
MICATEX
One of the most difficult of all drilling problems is encountered in drilling through loose, creviced or fractured formations heavily charged with gas. Unless the drilling mud has adequate weight, the well may blow out. (See Fig. 1.) This weight which is necessary to hold the gas pressure may be great enough to cause loss of circulation in the permeable formation. (See Fig. 2.) Providing adequate mud weight to control pressures and not thereby lose circulation was an extremely difficult problem until MICATEX was introduced to the oil industry.
MICATEX seals the walls of the formation and helps prevent loss of circulation. (See Fig. 3.)
This ability of MICATEX to help prevent blowouts and lost circulation is proved in the following drilling problem encountered in the Gulf Coast. A well at 9447 feet struck a loose, high-pressured gas sand and attempted to blow out with a mud weight of 11.7 pounds per gallon (88 pounds per cubic foot). The mud weight was increased, but when it reached 12.2 pounds per gallon (91 pounds per cubic foot) circulation was lost. The well was shut in and MICATEX was added at the rate of 5 pounds per barrel to a pit of mud weighing 12.5 pounds per gallon (94 pounds per cubic foot). This mud was then pumped into the hole, and indications showed that circulation was re-established soon after the MICATEX-mud left the drill pipe. Weight was then raised to 13.8 pounds per gallon (103 pounds per cubic foot) with no further loss of mud.
The well was drilled to 9651 feet with no additional trouble. At this point casing was run and the operators reported that the well "was so satisfactorily walled-off that the pipe didn't touch a thing." During the cementing operation full mud returns were obtained the whole time the 16-pound-per-gallon slurry was being run, further indicating the ability of MICATEX to provide an effective mud seal and a clean hole.
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Fig. 1.
Fig. 2.
Fig. 3.
BAROID PRODUCTS: BAROID AND COLOX, AQUAGEL, FIBROTEX, BAROCO, STABILITE, AQUAGEL CEMENT, SMENTOX, ZEOGEL, IMPERMEX, MICATEX, TESTING EQUIPMENT, BAROID WELL LOGGING SERVICE

PIPE LINES

Multiple-Fluid Pipe Lines—F. B. Haverfield, in PETROLEUM ENGINEER, Vol. 14 (1943), No. 6, pp. 151-2; 155.

This paper describes an installation in which crude oil and natural gas are transported to market through the same pipe line. This is an 8-inch line that originates at Continental Oil Company's Lake Arthur field near Jennings, Louisiana, and extends to the same company's natural gasoline plant at Gillis in the same state. The distance is 27.8 miles. Looking at this installation from one point of view, it can be regarded as mainly a rather long gathering line from the wells to the absorbing plant; from that standpoint the idea is an old one. Looking at it from another standpoint it is a distinct novelty, in that oil and gas, which usually go to market through different channels, are here transmitted through the same conveyor. The chief advantage of such a system appears to be that less steel will be needed for building a pipe line to carry a mixture of gas and oil than would be required if the two substances were transported through separate lines. (This is due to the fact that gas is more or less soluble in crude oil; by dissolving it in oil under pressure the gas is virtually reduced to liquid form and hence occupies a reduced volume.)

The Jennings field has distilate characteristics. The liquid recovery is readily obtained in field separators by reducing the flowing pressure to within retrograde condensation limits. The oil and gas are both metered in the field. The gas passes through an activated alumma dehydrator to remove sufficient water to prevent the formation of hydrates which would freeze and block the line. Thereupon the gas and oil are mixed together again and sent through the 8-inch line to the natural gas plant at Gillis. Here the two components are again separated in a 500-lb. separator. The crude oil is stabilized and sent to crude oil storage. The wet gas is measured and then passes through a 500-lb. absorber, and from there goes into the gas main for distribution as fuel gas. As there is ample wellhead pressure, the line is operated and the high-pressure recovery equipment is controlled at the discharge end of the line under well pressure.

The design of a pipe line to carry both oil and gas

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From the days of Colonel Drake, the oil fraternity's clear vision, unswerving courage and stalwart leadership have overcome such obstacles as lack of finances and equipment, inaccessible locations and transportation difficulties. In war or peace, *the oil man carries on with plenty of courage and baling wire.* And Johnston deems it an honor to be serving an industry which is contributing so much to the development of the world's natural resources.

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is based on the known properties of the two substances and does not seem to offer any special difficulties; the author describes a rule of thumb method of calculation that suffices for most field operating conditions. Two years' experience with the system has not disclosed any noteworthy operating difficulties. On the whole, this installation, which so far appears to be the only one of its kind, offers an interesting suggestion for the design of pipe lines where oil and gas travel in the same direction to market.

NATURAL GAS

N.G.A.A. Tentative Standard Method of Calculation of High Pressure Gas Measurement—Bulletin of the NATURAL GASOLINE ASSOCIATION OF AMERICA, December, 1942; 50 cents.

This is the first publication of the N.C.A.A. High Pressure Gas Division. Other standards are being studied, including methods for obtaining a representative sample and for determining the specific gravity of gases from condensate wells.

The present standards takes into consideration two problems in the metering of natural gases through orifices under high pressure. First, the calculation of the quantity of gas flowing through the meter requires the density of the gas. This usually involves a choice of the correct compressibility factor to account for its deviation from ideal gas laws. Second, the reduction in pressure accompanying flow of a natural gas at high pressure may cause liquid to be present from retrograde condensation. This liquid may interfere with uniform meter operation and must be included in the density of the gas flowing.

Because of the nature of the subject covered, the material is not presented in the formalized style common to most technical standards. Instead, it appears as an informal discussion of procedure together with its supporting data and reference bibliography.

Part I presents a tentative standard for obtaining orifice correction factors to account for the deviation of gases from ideal gas laws at high pressure. This factor has been combined with the gravity and temperature factors to simplify the calculation of the meter quantity since both the gravity and temperature are required to determine the compressibility factor.

Part II presents the details of an investigation of the reliability of the compressibility factor method for gas density calculations and compares the experimental and calculated compressibility factors on a number of natural gases.

The procedures for establishing standard meter factors, including the deviation from ideal gases, are as follows, depending upon the accuracy desired:

Case (1) For the highest degree of accuracy, a gas analysis should be obtained to eliminate any doubt as to pseudo criticals. The errors in metering due to gas density alone should not exceed one percent on the average.

Case (2) For average metering of high pressure gases of varying gravity, representative analyses should be obtained to be used to establish a curve of gas gravity vs. pseudo critical temperature and pressure. From this curve, a chart or series of tables should be prepared giving the meter factors at even gas gravities. The errors in metering due to gas density alone should not exceed two percent on the average.

Case (3) For metering gases which vary in composition in cases where only one or a very few gas analyses are available, select the high (H), average (A), or low (L) pseudo critical gas gravity curve and use the corresponding meter factors.

Case (4) For metering gases of unknown composition.

Storage of Natural Gas for Peak Loads—W. E. Steinwedell, in JOURNAL WESTERN SOCIETY ENGINEER, Vol. 47 (1943), pp. 274-278.

One of the difficulties confronting gas companies which distribute natural gas brought by pipe line from distant fields is to provide a supply for peak loads. A system that is adequate for mild weather conditions may and often has proved more or less inadequate in the face of prolonged severe winter weather. There are two obvious solutions: one to build pipe lines capable of meeting peak loads as they come; the other is to store gas during summer and slack seasons for use in emergencies.

A gas company in Cleveland has elected to meet the problem by building tanks in which liquefied natural gas can be stored at low temperature. The original installation, erected about two years ago, consists of three spherical steel tanks, each enclosing a smaller concentric steel tank; the space between the two concentric tanks is filled with cork insula-

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tion. Gas coming in through the pipe lines, mostly from West Virginia, is liquefied at the rate of 3,500,000 cu. ft. a day, which is compressed to about 264,000 cu. ft. of liquid. When an extra supply of gas is needed the liquid gas is taken from cold storage by three pumps which force it through steam heated regasification units against the 30 lbs. gage pressure of the city high-pressure mains. After being regasified the gas is warmed up to about 50° F.

In operation, this system increased the available supply for peaks at about one-half the cost of building a new pipe line to the gas fields. In view of this demonstrated success, it was decided to increase the capacity of the system with another tank to hold the equivalent of 100,000,000 cu. ft. of natural gas. The new tank is cylindrical, with an inner nickel-steel shell 70 feet in diameter and 42 feet 10 inches high; the outer shell is 76 feet in diameter and is 51 feet high. There has been no shortage of gas in Cleveland during the two winters since this plan has been followed.

The author states that liquefaction plants should be of a size that will fill the storage capacity in about 60 days or less. The design of the liquefaction plant will vary, depending on the pressure of the gas as delivered for liquefaction, and the pressure desired as the gas is delivered to the distributing system. Existing steam plant, cooling water and economical boiler fuel must also be considered. The cost will vary on the above items as well as on freight rates, labor, and character of soil for foundations. The operating cost will depend on local requirements, such as the amounts of gas regasified annually, cost of labor, natural gas for engine fuel, boiler fuel, supplies, maintenance and repairs, and other miscellaneous items. Each installation requires study of all local conditions.

Chemical Utilization of Natural Gas and Gasoline Hydrocarbons by Oxidation—Hooper Linford, before CALIFORNIA NATURAL GASOLINE ASSOCIATION, 17th Annual Meeting, Los Angeles, November, 1942.

Natural gas is mostly ethane and methane; the amounts of propane, butane and pentane and higher hydrocarbons obtained as natural gasoline are small in comparison.

Dry gas has its uses and a certain value as fuel, but it is possible to put at least a portion of the enormous available quantity to a more profitable use. Methane and ethane can be converted by oxidation into commercial products that have a high unit value, although the market for these products is somewhat limited. This is now being done on a commercial scale in at least one large plant (Cities Service Oil Co. at Tallant, Okla.). The operation is relatively simple. It consists in compressing a mixture of natural gas and air and passing the mixture through a reaction vessel in which a regulated high temperature is maintained. On leaving the reaction vessel the liquid reaction products are cooled and separated from the unoxidized gas, which may be recycled. Details of the operation have not been disclosed, but it is supposed that a catalyst is employed in the reaction.

The main products of the reaction are methanol and formaldehyde in about equal proportions, along with appreciable amounts of acetaldehyde and acetone. Both formaldehyde and methanol are obtained in the pure state; formaldehyde is obtained as a 40 percent solution (formalin) in water; a mixture of methanol and acetone is sold as a commercial solvent.

Both formaldehyde, and indirectly methanol, are consumed in large quantities in the synthetic resin industry, and enter into the composition of about half of the molded plastics manufactured in the United States, including such well known products as Bakelite, Beetle, Plaskon and Ameroid. Plastics are now largely used in war production, and consequently a shortage has arisen in both formaldehyde and methanol since early in 1941. This shortage was made more stringent because of the enforced conversion of existing synthetic methanol facilities to the production of ammonia. It is considered unlikely that these facilities will again resume the production of methanol and formaldehyde when the emergency has passed, because they use high pressure processes and may find it difficult to compete with the cheaper natural gas process, which employs relatively low pressures and temperatures. It is expected that after the war the plastics industry will undergo a large expansion, and since the high pressure processes are not likely to come back into this field, more natural gas oxidation plants like the one at Tallant will be needed.

ASPHALT AND TAR

Asphalt-Polybutylene Paints—H. C. Evans, D. W. Young, and R. L. Holmes (Standard Oil Co. of N. J., Elizabeth, N. J.), in INDUSTRIAL ENGINEERING CHEMISTRY, Vol. 35 (1943), No. 4, pp. 381-487.

Recent work on the general subject of petroleum asphalt-polybutene blends has followed two general lines, the first being a study of the effect of polybutene on the physical properties of asphalt as determined by standard laboratory instruments. It has been found that, in general, the softening point,

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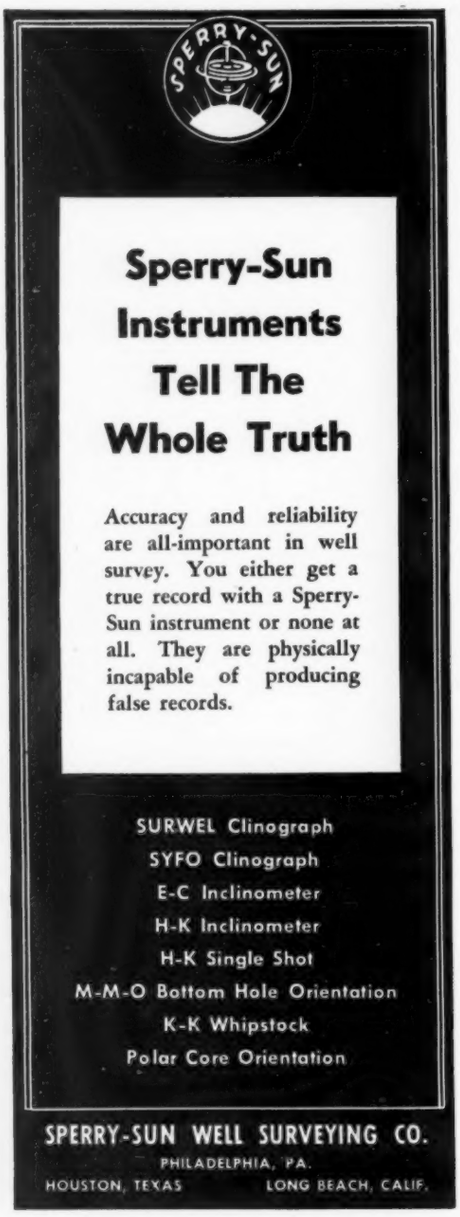

penetration, ductility, and similar standard asphalt tests are influenced not only by the molecular weight of the polybutene but also by the type of asphalt in which it is blended.

The authors have now made a study of a more practical character, addressing themselves to the effect of low concentrations of polybutylene on the weathering and surface consistency characteristics of more than 70 experimental asphalt-polybutylene cutbacks, with and without fillers.

It was found that less than 10 per cent polybutene of 6,000-15,000 molecular weight in oxidized and steam-reduced asphalts reduced or completely eliminated the tendency of the asphalts to alligator, slightly reduced the tendency to check, reduced surface hardness, and increased the length of time before dusting began.

Films having better appearance and resistance to weathering were formed from cutbacks containing highly aromatic solvents than from cutbacks containing high paraffinic solvents.

Polybutene of 6,000-15,000 molecular weight also improved the weathering resistance of inert filler-asphalt films.

With fillers steam-reduced asphalts were more favorable than oxidized asphalts; without fillers the reverse was true.

All coatings on red lead primer were superior to those on polished steel.

In general, the improvement was proportional to the polybutene content, the polybutene film of higher molecular weight having better physical properties; but films containing over 10 per cent polybutene were either too tacky, for the low-molecular-weight polybutene, or too viscous for easy application in the case of the polybutene of higher molecular weight.

CHEMISTRY

Catalytic Alkylation of Benzene with Ethylene—W. A. Pardee and B. F. Dodge, in INDUSTRIAL ENGINEERING CHEMISTRY, Vol. 35 (1943), No. 3, pp. 273-278.

Since the manufacture of styrene (ethylbenzene) for production of synthetic rubber has begun, processes by which it might be synthesized have become of interest. The larger producers of ethylbenzene use an agitated liquid phase for contacting benzene with ethylene in the presence of a halide metal catalyst, such as aluminum chloride. The present investigation is concerned with the reaction of ethylene and benzene in the vapor phase by passing the mixed vapors through a catalyst bed.

Eleven different catalysts were tried. Sodium chloride — aluminum chloride — pumice and phosphoric acid-kieselguhr were the only catalysts giving detectable reactions. Mono- and diethylbenzenes were identified in the liquid products. The former catalysts under some conditions converted as much as 95 percent of the ethylene to ethylbenzenes.

A series of runs was made to determine the effect of time, pressure, and space velocity on the reaction when the sodium chloride—aluminum chloride —pumice was used. The catalyst was found to have a very short life, the ethylene conversion decreased from 93 to 75 percent over a period necessary for the conversion of 0 to 1.16 gram mole of ethylene to ethylbenzenes.

Pressure had a surprising influence on the reaction. At atmospheric pressure there was no detectable conversion, while at 200 pounds gage pressure as much as 95 percent of the ethylene was converted to ethylbenzenes.

The effect of space velocity on the conversion was negligible over the range of about 11 to 50 cc. per hour per cc. of catalyst.

The Applicability of the A.S.T.M. Lamp Method for Determining Sulfur in Lubricating Oils—Ernest L. Korb and Edward K. Cornelius (Petroleum Chemicals Testing Laboratory, E. I. du Pont de Nemours & Co.), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

A method which is simple, accurate, and reproducible has been evolved for the determination of total sulfur in straight and compounded lubricating oils. This method employs the A.S.T.M. sulfur lamp equipment with only one slight modification. The procedure comprises burning a 72:25 percent by weight mixture of A.S.T.M. naphtha and lube oil and the sulfur liberated in the combustion is determined gravimetrically as $BaSO_4$.

Results on a number of samples evaluated in the A.S.T.M. sulfur bomb by other cooperating laboratories did not show particularly good agreement. In general, the modified lamp procedure gave results close to the average, or slightly higher than those obtained by the conventional method.

The method has since been extended successfully to all types of heavy fuel oils, so long as they are free of suspended material.

Alkylated Cresols from Refinery Gases—Whitney Weinrich, in INDUSTRIAL ENGINEERING CHEMISTRY, Vol. 35 (1943), No. 3, pp. 264-272.

The search for more efficient anti-oxidants for petroleum fractions has led many investigators to consider the alkylated phenols. Mono and dialkyl phenols have become known, but not until 10 years ago were the trialkylated alkyls taken up for study, from which has emerged a whole new class of organic chemicals.

Trialkylated phenols may be obtained by treating phenols with an excess of tertiary olefins. Phenols react selectively with the isobutylene contained in refinery butane-butene fractions in the presence of catalytic amounts of concentrated sulfuric acid to form the corresponding *tert*-butyl derivatives. Conditions have been determined for the synthesis of 2,6-di-*tert*-butyl-4-methylphenol and of 4,6-di-*tert*-butyl-3-methylphenol from a commercial *m*-*p*-cresol cut of coal tar acids, and continuous separation of the dibutyl cresols by distillation has been accomplished. Early pilot plant work on this problem is briefly sketched and is followed by a more complete description of a small commercial plant for the manufacture of *tert*-butyl derivatives of *m*- and *p*- cresol.

Rapid Determination of Water in By-Products Sulphur — Louis Schnidman, before American Chemical Society, Division of Gas and Fuel Chemistry, Detroit, April, 1943.

By-product sulfur, sometimes known as sulfur paste, recovered during the purification of manufactured, natural, or refinery gases using liquid

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purification and sulfur recovery processes, is being used extensively as a fungicide. The texture and consistency of the specially milled and creamed sulfur are controlled by its water content during its production. A rapid density method for the determination of water in the by-product sulfur has been developed, requiring no weighing, but merely liquefying the sulfur paste, deaerating the sample by suction with constant stirring in a special metal container, counterbalancing a given weight, and reading the moisture content directly from a calibrated flask. The accuracy of the density method has been established by comparison with a distillation procedure previously developed. The rapid density method will give results within 0.5 per cent of the true water content of byproduct sulfur. The time required for a determination is ten minutes.

Stability of Butadiene—Richard F. Robey, Herbert K. Wiese, and Charles E. Morrell (Esso Laboratories, Standard Oil Development Co., Elizabeth, N. J.), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

The study of the reactions which butadiene undergoes during storage and plant processing has been made. The two reactions of most interest are: (1) dimerization by a Diels-Alder type condensation, and (2) polymerization to plastic materials of high molecular weight. The first reaction is bimolecular and homogeneous in the liquid phase under a variety of conditions. Bimolecular reaction rate constants have been determined for a range of temperatures and compared with the constants for the gas phase reaction. The magnitudes of these constants are quite close. Formation of higher molecular weight polymers is peroxide-catalyzed. For a number of peroxide catalysts the rate of polymerization to plastic substances is proportional to the square root of the peroxide concentration. Data on the rate of peroxidation of butadiene are given.

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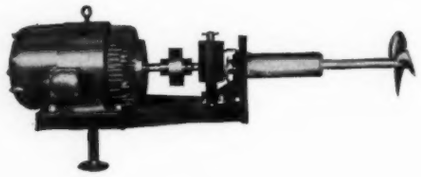

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Relationship Between the Total and Net Heating Values of Natural Gas as Determined with a Water Flow Gas Colorimeter—A. J. W. Headlee and James L. Hall, before DIVISION OF GAS AND FUEL CHEMISTRY, American Chemical Society, Detroit, April, 1943.

The total and net heating value of natural gas are related by the mathematical expression $Thv - 1.072\ Nhv = 34 - 0.341$, where Thv is the total heating value, Nhv the net heating value and I the percent of inerts.

This equation is used to check the accuracy of the corrections for the water of combustion of a water flow gas colorimeter. The net heating value can be calculated from the total heating value by using this expression, and vice versa.

The rate of condensate water runoff must be very uniform in order to obtain duplicate net heating values within narrow limits. Longer test periods counterbalance the effects of pulsations in the runoff. However, this requires a greater number of man hours and larger samples.

Method for Determining Oxygen in Hydrocarbon Gases—Karl Uhrig, F. M. Roberts, and Harry Levin (The Texas Co., Beacon, N. Y.), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY Detroit Meeting, April, 1943.

A method is described for determining oxygen in concentrations of 0.001 to 5 percent. Oxygen is reacted with copper wetted with ammonia-ammonium chloride solution, the resulting mixed oxides are dissolved in the same solution, reduced to cuprous form, and copper is determined iodometrically as a measure of oxygen in the sample. The method gives accurate results in saturated and unsaturated hydrocarbon gases. Sulfur dioxide, hydrogen sulfide, and mercaptans must be removed and means for doing so are provided.

The method is based on well-known reactions but many modifications have been made, in technique and equipment, which have produced an accurate usable method.

The Existent Corrosivity and Potential Corrosivity of Lubricating Oils — George W. Waters and Hugh D. Burnham (Wood River Research Laboratories, Shell Oil Co., Inc., Wood River, Ill.) before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

Bearing corrosion is analyzed into two concepts "existent corrosivity" which is that occurring by virtue of the instantaneous chemical state of the lubricant, and "potential corrosivity" which is that occurring under conditions, representative of those of service, which lead to the simultaneous oxidation of the oil. The effects upon both types of corrosivity of temperature, time, the nature of the

An Important Decision on Synthetic Rubber for Tires

For more than a year this company's Buna rubber patents have been royalty-free to everybody for the duration of the war. On April 15th, 1943 we offered, subject to the approval of our stockholders, to transfer *permanently* to the U. S. Government (through the Government's Rubber Reserve Company) patent rights on Buna-S . . . the tire rubber which forms the basis of the Government's synthetic rubber program. The Government's Rubber Director and Rubber Reserve Company have accepted this proposal. This is the first time, to our knowledge, that any company has offered to Government the right to license important patents—royalty-free—forever—to everyone—even to its competitors.

UNDER THE PROPOSAL:

1. **The Government will have a free license for itself not only during the war, but for the entire life of the patents.**
2. **During the war the Government will have the right to issue royalty-free licenses for the entire life of the patents to everyone who cooperates with the Government in its war rubber program and reciprocates with similar licenses under its own patents.**
3. **There will be no payments to us or to others for the patent rights used.**
4. **The Government will increase its expenditures on synthetic rubber research to a total of not less than $5,000,000.**

OUR PURPOSES:

1. **To give every possible incentive to cooperation in the war rubber program.**
2. **To remove concern about the post-war patent situation from the minds of all those who have a contribution to make to this program.**
3. **To encourage American research and ingenuity—among independent workers, small companies and large—to build up a new and great American industry.**
4. **To continue to do everything we can to assure tires for America's cars—*always*.**

FACTS ABOUT BUNA

In 1929 we bought from I. G. Farbenindustrie of Germany a minor interest in their Buna rubber processes for use outside of Germany.

•

During the 1930's these processes were further developed. The quality of Buna was improved, the range of its use widened.

•

In 1939—two years before Pearl Harbor—we bought out *all* German rights in the Buna processes for the U. S. A. Soon after, two large tire companies took out licenses. We also began building a Buna rubber plant of our own.

•

When war threatened the loss of our country's natural rubber supply, authorities agreed that Buna-S was America's best bet for tires. It became the basis of the Government's synthetic tire program.

•

Today the Government is spending over six hundred million dollars on its Buna-S program. Six rubber plants are in operation. By the end of 1943 completed plants will have a capacity of 705,000 tons per year, or more than the entire normal peace-time rubber requirements of the United States.

STANDARD OIL COMPANY
(*NEW JERSEY*)

oil, concentration of reactants, and the physical factors of the tests are described. The important function of protective lacquer films in preventing corrosion and the interference with their action by detergents are demonstrated.

Determination of Disulfide Sulfur in Gasoline—George W. Ayers and M. S. Agruss (The Pure Oil Co.), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

It has been shown that organic disulfides have an adverse effect on the susceptibility of gasolines to tetraethyl lead and therefore the determination of organic disulfides in gasolines is of considerable importance.

No completely satisfactory method for the determination of such small quantities of disulfide sulfur in gasoline is available in the literature. The reduction of disulfides in the presence of zinc and acetic is fraught with many difficulties which have been overcome by (1) the use of a trap to prevent the escape of volatile mercaptans formed, (2) the shortening of the time necessary, and (3) the direct titration of the acetic acid-gasoline mixture without a preliminary water wash.

A Method for Evaluating the Oxidation Stability of Distillate Fuel Oils—J. R. Sabina, R. O. Bender and E. L. Korb, before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

A method for measuring the progress of fuel oil oxidation under controlled conditions has been developed which can be used to study the effect of chemical treatment of contaminants, of storage conditions, and of chemical adjuvants on fuel oil stability. Data are presented to illustrate each of the applications. Equipment and technique adopted by A.S.T.M. for gasoline testing is used. Data are also presented to show the correlation and the present method. The authors believe that it is a useful tool for the study of fuel oil deterioration.

Analysis of the Light Constituents in Crude Petroleum by Low-Temperature Fractional Distillation—R. J. Askevold and M. S. Agruss (The Pure Oil Co.), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

Auxiliary equipment is described which is used in conjunction with the low-temperature fractionating column for the determination of the light constituents in crude petroleum. The results obtained by means of this smaller equipment compare very well with those obtained by pilot plant operation on larger quantities of sample. The method can be used for the calculation of material balances on distillation and cracking units in oil refineries where it is desirable to know the composition of the light gases occurring in the original crude oil charge.

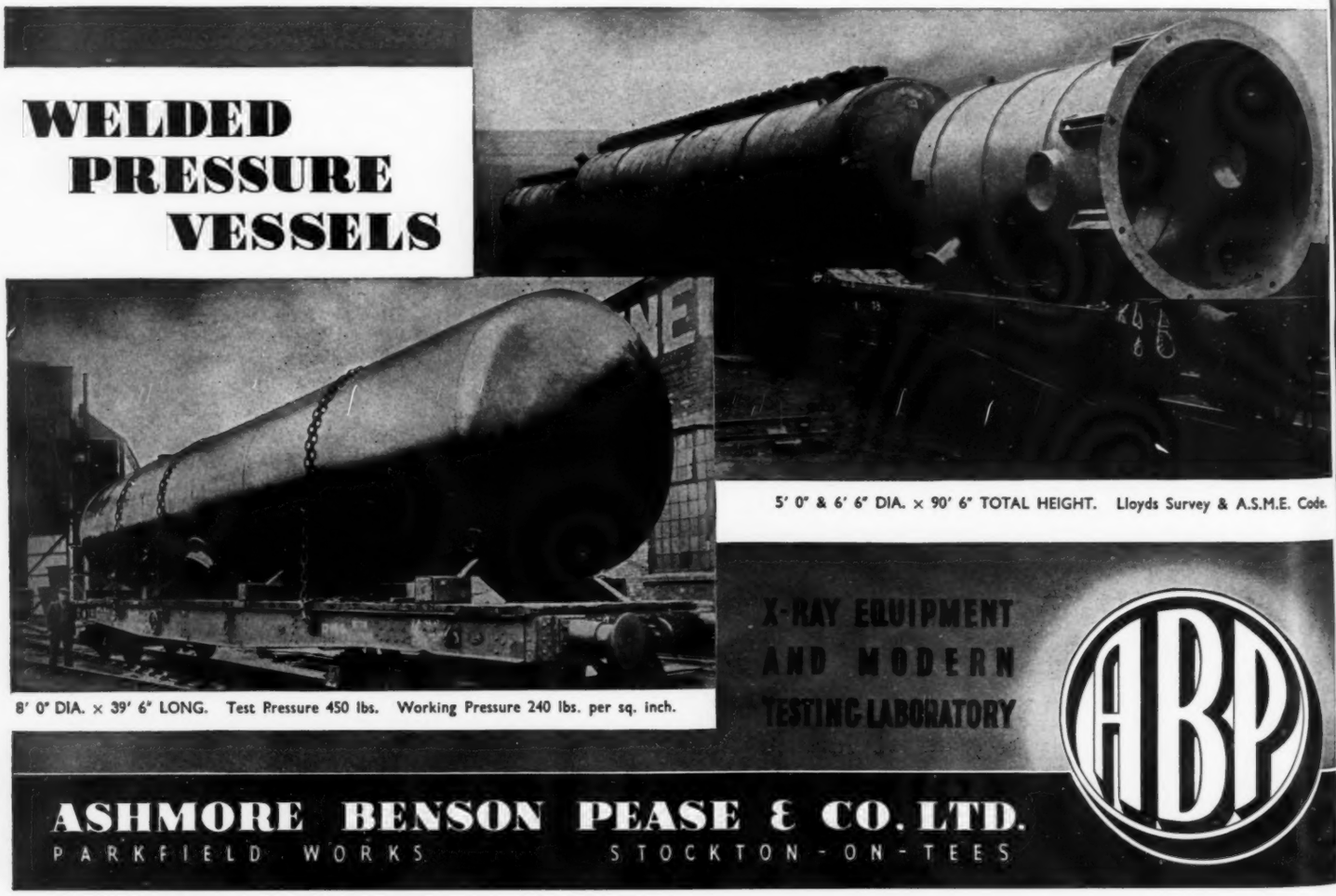
Determination of Water in Hydrocarbon Gases—Harry Levin, Karl Uhrig, and F. M. Roberts (The Texas Co., Beacon, N. Y.), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

A method is described for determining water (vapor or dissolved) in hydrocarbon gases. It is based on the observation that when a gas containing moisture is contracted with cold dehydrated acetone, the water is retained by the acetone in which it can be determined by an acetyl chloride method. Olefins and diolefins do not interfere and provision is made for correcting for interference by acidic or basic constituents of sample.

PHYSICS

Volumetric and Viscosity Studies of Gas and Oil from the Santa Maria Valley Field—R. H. Olds, B. H. Sage and W. N. Lacey, in PETROLEUM TECHNOLOGY, March, 1943, Technological Publication No. 1588; 11 pages.

In recent years a reasonable quantity of experimental data has been accumulated concerning the volumetric behavior and the viscosity of hydrocarbon systems. One of the main objectives for such work is the attempt to predict the properties of naturally occurring hydrocarbon mixtures under the conditions encountered in nature. At the present time the volumetric behavior of homogeneous hydrocarbon mixtures can be predicted with reasonable accuracy within certain ranges of composition over a relatively wide range of temperature and pressure. Heterogeneous systems offer a more difficult problem. The viscosity of both simple and complex hydrocarbon mixtures has been investigated in some detail. Nevertheless, information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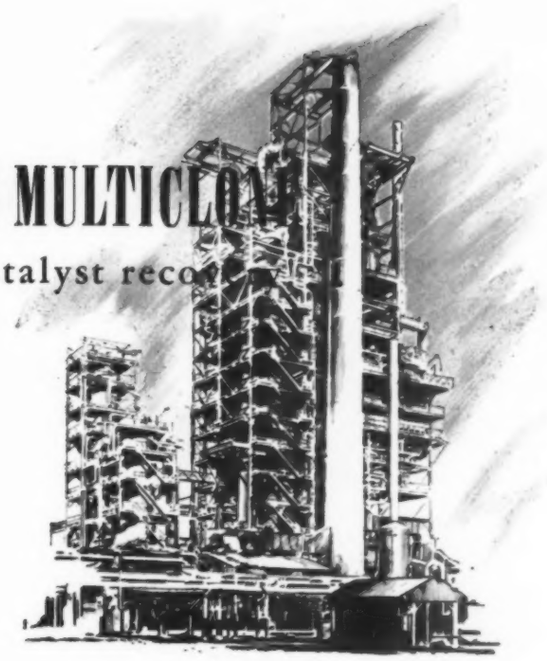

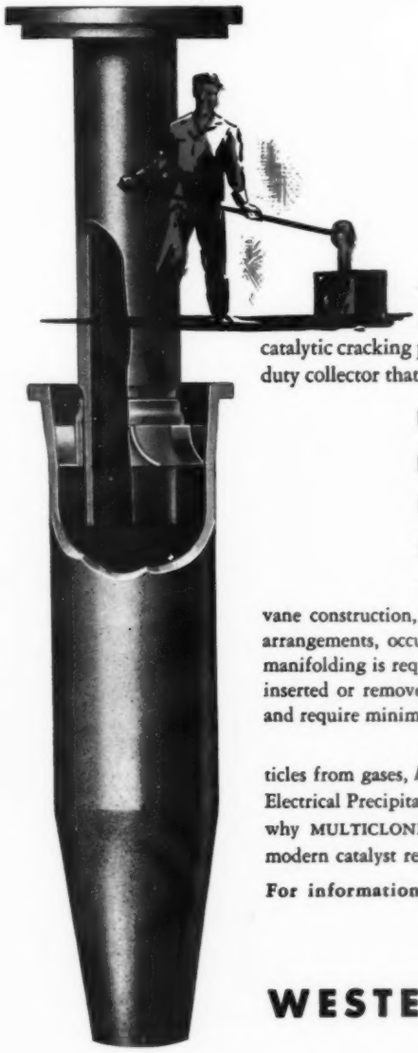

The unusually high temperatures—above the working range of ordinary steels—call for special consideration in the selection of collectors for catalytic cracking processes. The *cast* tubes in the MULTICLONE provide a rugged, heavy-duty collector that offers important advantages...

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- **Each tube can be handled independently of the others.**
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- **The tubes, being cast, can be made of any required material.**

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regarding this property is as yet insufficient to permit dependable forecasts for many cases of practical interest. For this reason a study of the volumetric behavior and the viscosity of the liquid phase of several mixtures of oil and gas from the Santa Maria Valley field was carried out.

The work included determination of the viscosities and specific volume, at temperatures of 100°, 190° and 250° F., of "trap gas" and "trap liquid" from the surface separator and mixtures of these phases under various pressures up to 4,000 lbs. p. s. i.

The results obtained yield an almost linear relation of formation volume to gas-oil ratio throughout the heterogenous region covered, and show that the viscosity of the liquid phase of a mixture reaches a sharply defined minimum at the bubble point of the mixture. The authors devise a relatively simple equation which permits calculation of the viscosity of the condensed liquid phase (at the experimental pressures) from a knowledge of the state and the bubble-point pressure composition.

The equation is:

$$\log \eta = \log \eta_b + \alpha(P - P_b)$$

The nomeclature of this equation is:

- η Viscosity, centipoises.
- η_b Viscosity of bubble-point liquid, centipoises.
- P Pressure, lb. per sq. in. absolute.
- P_b Bubble-point pressure, lb. per sq. in. absolute.
- α Coefficient which is a function of bubble-point pressure and temperature, although the effect of pressure on it may be neglected for purposes of the present correlation.

The Viscosities of the Methane-Propane System—Leo B. Bicher, Jr., and Donald L. Katz (University of Michigan), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

The viscosities of methane, propane, and four of their binary mixtures (20, 40, 60, 80 mole % CH_4) have been determined with an average error of 3.2 percent at eight pressures (400 to 5000 lbs. per sq. inch) at each of five temperatures (77° to 438°F.) using a rolling ball—inclined tube type viscometer. These data are correlated by the three variables, molecular weight, pseudo-reduced temperature, and pseudo-reduced pressure, with an average deviation of 2.9 percent. This correlation may be used to obtain the viscosity of any light paraffin hydrocarbon or hydrocarbon mixture with an average error of less than 3.5 percent.

Viscosity of Solutions in Branched Paraffins—E. H. McArdle and A. E. Robertson (Esso Laboratories, Research Division, Standard Oil Development Co., Elizabeth, N. J.), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

Solutions of an alkyd type resin, and of a natural and two substitute rubbers, at high concentrations in two pentanes, four hexanes, five heptanes, and two octanes, show much higher absolute and relative viscosities in the branched paraffins than in the corresponding normal paraffins. An arbitrary method of predicting the viscosity of the resin solutions in branched paraffins has been devised; and an attempt made to use such values in a method of hydrocarbon analysis.

An Improved Automatic Gas Effusiometer—Leonard C. Drake, before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

An improved automatic gas effusiometer based on the measurement of the time for the gas to pass through a standardized orifice (Schilling method) is described. The apparatus employs salt solution as the confining liquid and a series-parallel electric circuit to start and stop an electric stop clock. Electric relays and strategic mercury are not required. The specific gravity of gases, including those containing hydrogen sulfide, may be determined to the third decimal place. The apparatus may be adapted for use in measuring time intervals with other laboratory equipment.

USES

The Stability of Furnace Oil—A. B. Hersberger, H. C. Cowles, and B. Zieber (The Atlantic Refining Co.), before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Detroit Meeting, April, 1943.

The fouling of domestic oil burner systems by unstable furnace oils is discussed. A stability test is described and data are presented relating this test to results obtained by circulating oils through the essential parts of a gravity feed burner system, the latter results having been found to correlate with practice. Data on both refined and unrefined oils are included. The stability test is based on the reaction of oils to two metal pairs, iron-copper and iron-lead, under controlled conditions.

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